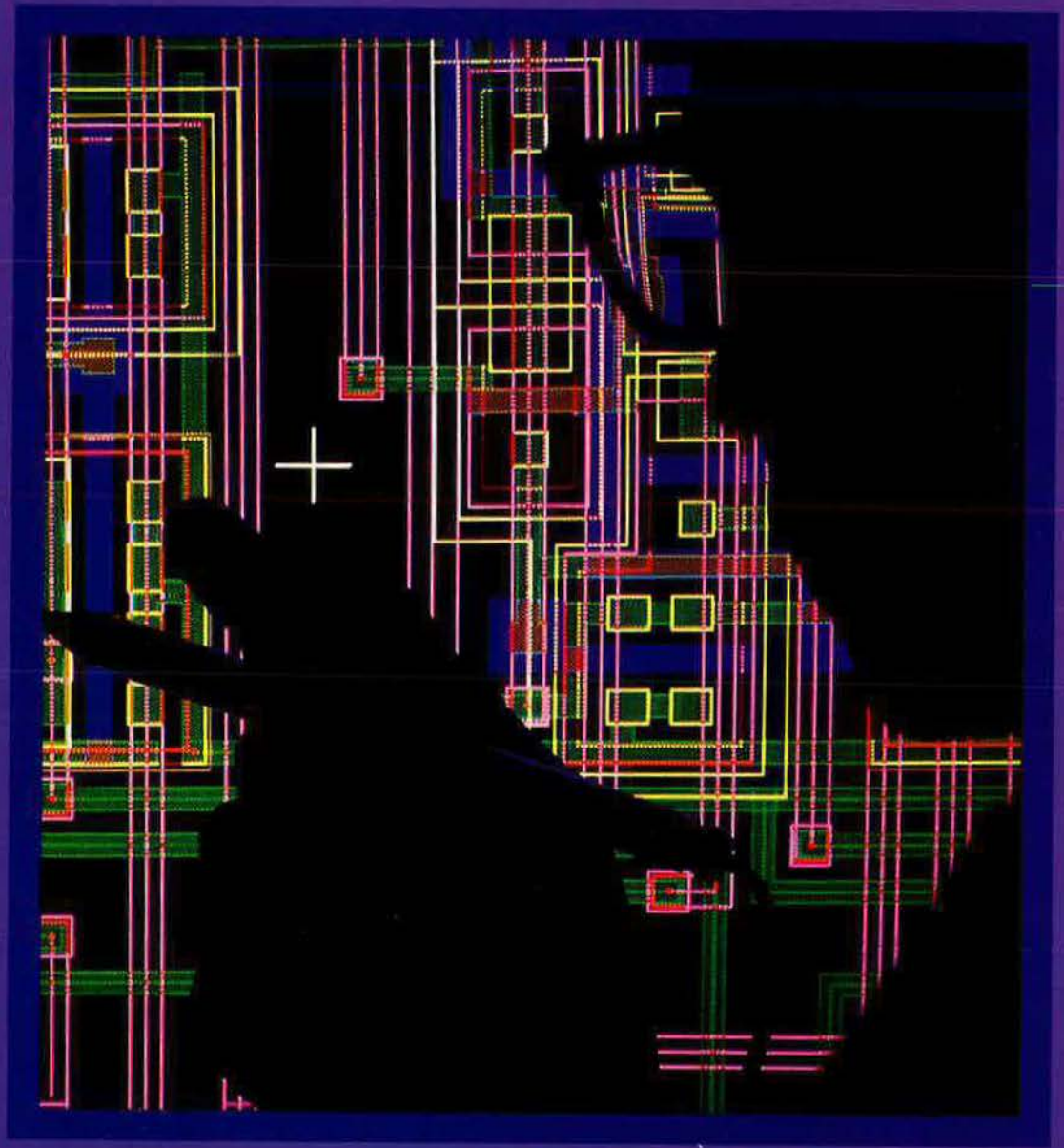
AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

# TECHNOLOGY AND DEFENSE



HERE COME THE SUPERCHIPS
INDUSTRY LOOKS AHEAD
WHAT DRIVES THE DEFENSE BUDGET

# TURN THE KC-135 INTO A LONG DISTANCE RUNNER?

It's happening with the CFM56-powered KC-135R. And the U.S. Air Force is taking great strides into the future. The CFM56 is not only giving the KC-135R nearly double the thrust, it's increasing the tanker's fuel offload capability as much as 150%. Which means the KC-135R is getting off the mark with more muscle. And traveling further, much further, down the track, with an average increase of 50% in productivity over the current KC-135. The CFM56 is taking the KC-135R over many other hurdles, too. By reducing its noise footprint by 98%. By giving it the ability to sprint from shorter fields. And by flying across the finish line with a 25% decrease in fuel consumption and a substantial reduction in maintenance costs. When the re-engined KC-135Rs enter service in the mid-1980's, the CFM56 will have logged nearly two million hours of commercial experience. So the U.S. Air Force is taking on its team an engine that has been a proven winner in many a swift race.

cfm international

A JOINT COMPANY OF SNECMA, FRANCE AND GENERAL ELECTRIC COMPANY, U.S.A.




SHOE: HYDE ATHLETIC INDUSTRIES, INC.

# ONLY THE CFM56 CAN DO IT!

# When good just isn't good enough...

## Come to Fairchild Weston

**Our cost-effective systems solutions combine innovation, high technology and rugged reliability to meet your needs in:**

- Aerial Reconnaissance
- Battlefield Surveillance
- $C^3$ Countermeasures
- Automatic Test Equipment
- Telemetry
- Data Recording

**Building on an experience base developed over 60 years, our high performance products are known for their quality the world over.**

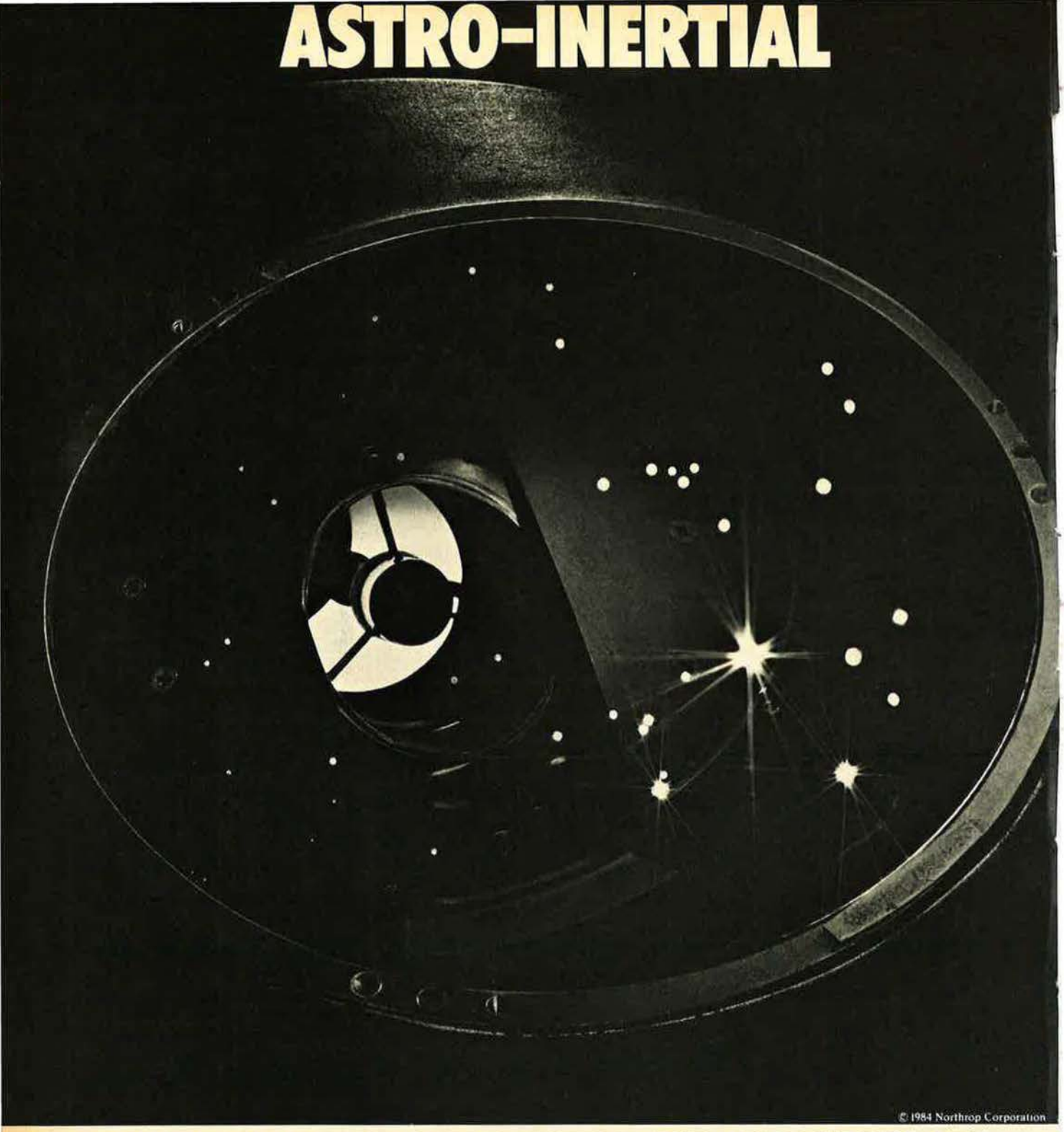
**When your need is for the best solutions to your systems problems, *come to Fairchild Weston.* 300 Robbins Lane, Syosset, New York 11791 (516) 349-2200 · TWX 516-221-1836**

**FAIRCHILD WESTON SYSTEMS INC.**

FAIRCHILD WESTON
Schlumberger

***Excellence in Defense Systems Technology... Worldwide***

# ASTRO-INERTIAL





## FOR UNEQUALLED AIRCRAFT NAVIGATION AND WEAPONS DELIVERY.

Precision inertial system coupled with highly accurate Star Tracker optics. From the Electronics Division of Northrop Corporation. Unmatched performance for weapons delivery. Day and night. For U.S. strategic bombers.

Exceptional position, velocity, and heading data. To initialize new air-launched missiles. Improves weapons delivery accuracy for systems such as AASM.

Places precision system on the aircraft, not on individual missiles. Reduces cost of total program. Passive. Cannot be jammed.

From Northrop. For over 30 years the world leader in astro-inertial systems. Astro-Inertial. Precise. Passive. Proven.

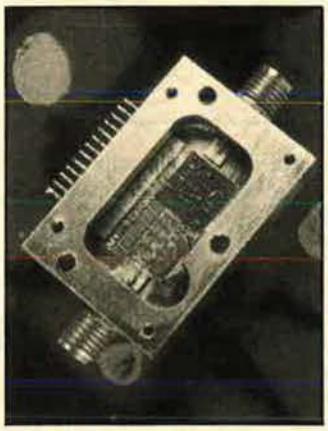
Northrop Corporation
Electronics Division
2301 W. 120th St.
Hawthorne, CA
90250 USA

**NORTHROP**

Making advanced technology work

APRIL 1984
VOLUME 67, NUMBER 4

AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION



Page 48

Page 94


**About the cover:** Color-coded computer-aided design is a valuable tool in creating integrated circuits. A special section on "Technology and Defense" begins on p. 48 of this issue. (Photo courtesy of Westinghouse Defense)

## Special Section: Technology and Defense



## Features



## Departments



**AIR FORCE Magazine** (ISSN 0730-6784) is published monthly by the Air Force Association, Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006. **Phone:** (202) 637-3300. Second-class postage paid at Washington, D.C., and additional mailing offices. **Membership Rate:** $15 per year; $42 for three-year membership. **Life Membership:** $250. **Subscription rate:** $15 per year; $25 per year additional for postage to foreign addresses (except Canada and Mexico, which are $8 per year additional). Regular issues $1 each. Special issues (Soviet Aerospace Almanac, USAF Almanac issue, Anniversary issue, and "Military Balance" issue) $3 each. **Change of address** requires four weeks' notice. Please include mailing label. **POSTMASTER:** Send change of address to 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006.

AIR FORCE MAGAZINE
PUBLISHED BY THE AIR FORCE ASSOCIATION

**Editor in Chief and Publisher**
Russell E. Dougherty

**Deputy Publisher**
Andrew B. Anderson

**Associate Publishers**
Charles E. Cruze, Richard M. Skinner

**Executive Editor**
John T. Correll

**Senior Editor (Policy & Technology)**
Edgar Ulsamer

**Senior Editors**
James W. Canan, William P. Schlitz

**Military Relations Editor**
James A. McDonnell, Jr.

**Contributing Editors**
Kathleen McAuliffe, Gen. T. R. Milton, USAF (Ret.), John W. R. Taylor ("Jane's Supplement"), Capt. Patricia R. Rogers, USAF

**Managing Editor**
Richard M. Skinner

**Assistant Managing Editor**
Hugh Winkler

**Director of Production**
Robert T. Shaughness

**Art Director**
William A. Ford

**Research Librarian**
Pearlie M. Draughn

**Editorial Assistants**
Grace Lizzio, Edward J. McBride, Jr.

**Assistant to the Executive Editor**
Corinna L. Petrella

**Advertising Director**
Charles E. Cruze
1750 Pennsylvania Ave., N.W.
Washington, D.C. 20006
Tel: 202/637-3330

**Director of Marketing Services**
Patricia Teevan—202/637-3331

**AREA ADVERTISING MANAGERS**
**East Coast and Canada**
By Nicholas—203/357-7781

**Midwest, Northern California, Oregon, and Washington**
William Farrell—312/446-4304

**Southern California and Arizona**
213/452-6173

**UK, Benelux, France, and Scandinavia**
Richard A. Ewin
Overseas Publicity Ltd.
91-101 Oxford Street
London W1R 1RA, England
Tel: 1-439-9263

**Italy and Switzerland**
Dr. Vittorio F. Negrone, Edlconsult Internationale S.A.S. Piazzo Fontane Marose 3
16123 Genova, Italy
Tel: (010) 543659

**Germany and Austria**
Fritz Thimm
645 Hanau am Main, Friedrichstrasse 15
W. Germany
Tel: (06181) 32118

BPA Circulation audited by Business Publication Audit

# AN EDITORIAL

# Bleeding of the Budget

WASHINGTON's annual "bleeding of the budget" is now upon us. The drawn-out contest between the Administration and Congress over the size and makeup of the Defense budget is getting under way with a vengeance. This year the temptation to play political hardball with bedrock national security requirements is extraordinary. The key reasons are election-year posturing, concerns about mounting budget deficits, and strong constituency pressures generated by the competitive effects that several major weapons programs have on one another.

Elsewhere in this issue, there is ample documentation of the fact that the Administration's FY '85 Defense budget request is austere, carefully balanced, and the slimmed-down product of thorough internal scrubbings. Regrettably, there is hard evidence that both fiscal conservatives on the right side of the political spectrum and the traditional defense critics on the left plan to make common cause, with proposed program deferrals and stretch-outs pointing toward major debilitating cuts of what in reality is a "minimum" budget, given our global responsibilities and the threats we face.

This set of circumstances invites, even provokes, congressional micromanagement of crucial weapons programs. It pits political and economic constituencies against each other. The acute danger of such intramural sniping is fratricide—with national security the principal but not necessarily the only casualty. Individual weapon programs are neither born nor bred in isolation; such programs are shaped and timed to provide mutual reinforcement with others and, in combination, to achieve the cohesive capabilities deemed essential to counteract the full range of military challenges. This pattern of deliberate timing and mutual support can't tolerate the removal of key building blocks without weakening the entire program structure.

A case in point is the current assault on the Air Force's carefully crafted Airlift Master Plan, especially the need for and specific mix of C-5Bs and C-17s, as validated by the Air Force, the other services, the Joint Chiefs of Staff, and the Secretary of Defense. The military needs both programs; it shouldn't be forced to kill one in order to get the other.

The crux of the issue is whether or not Congress will let political interests dictate weapon system procurements agreed to and recommended by the three services, the Joint Chiefs of Staff, and the Defense Department. The Airlift Master Plan provides for the acquisition of fifty C-5Bs, forty-four KC-10s, and, starting in 1992, 180 primary mission C-17s (210 total)—along with modernization of the Civil Reserve Air Fleet (CRAF)—to "meet the minimum intertheater airlift requirements, increase intratheater capability, and modernize both the active and reserve airlift structure." In February this year, the Air Force, Army, and Marine Corps reaffirmed the need for the C-17 in the post-1990 period by agreeing that the "design characteristics and performance capabilities incorporated in the C-17 make it the best solution to satisfy overall airlift requirements and meet long-range objectives." Congress should heed and implement the programs resulting from this strong and unambiguous interservice accord.

Mid-year, in both 1982 and 1983, our Association conducted major national seminars focused on the immediate and future needs of the services for global force projection. The consensus emerging from the participants in these in-depth seminars affirmed the specifics of the Airlift Master Plan. The programs flowing from this plan are designed to provide a cohesive, responsive airlift capability for our nation, and Congress should not be misled.

—RUSSELL E. DOUGHERTY, EDITOR IN CHIEF AND PUBLISHER


# As close as a CRT has ever come to thinking like a military pilot.

A pilot on a military mission has little time to make decisions. Split seconds at most.

Which means an avionics system has to do more than supply data. It has to supply the right information, at the right time, in an easy-to-read format.

At Collins Government Avionics, our second-generation color-display systems do just that—by automating both routine and complex functions, organizing information and effectively advising the crew with multi-function color CRTs.

These CRT displays use a variety of formats. For example: TV or FLIR pictures of the target overlaid with stores and EW information. Moving maps with flight routes and overlays of friendly as well as hostile installations. All tailored to the pilot's essential decision making needs. Whatever the aircraft, whatever the mission.

In the future, as missions are redefined, software changes can easily update the displays without expensive new hardware.

Collins color display systems. Improving the reliability of avionics with systems that reduce the number of displays and controls, weigh less, consume less power, and, above all, help pilots take the swiftest possible action.

Call us for more information about integrating avionics systems with color CRT displays. We think it's a technology that will lead to swift action on your part, too.

**Collins military color CRT displays.**

**COLLINS GOVERNMENT AVIONICS DIVISION**

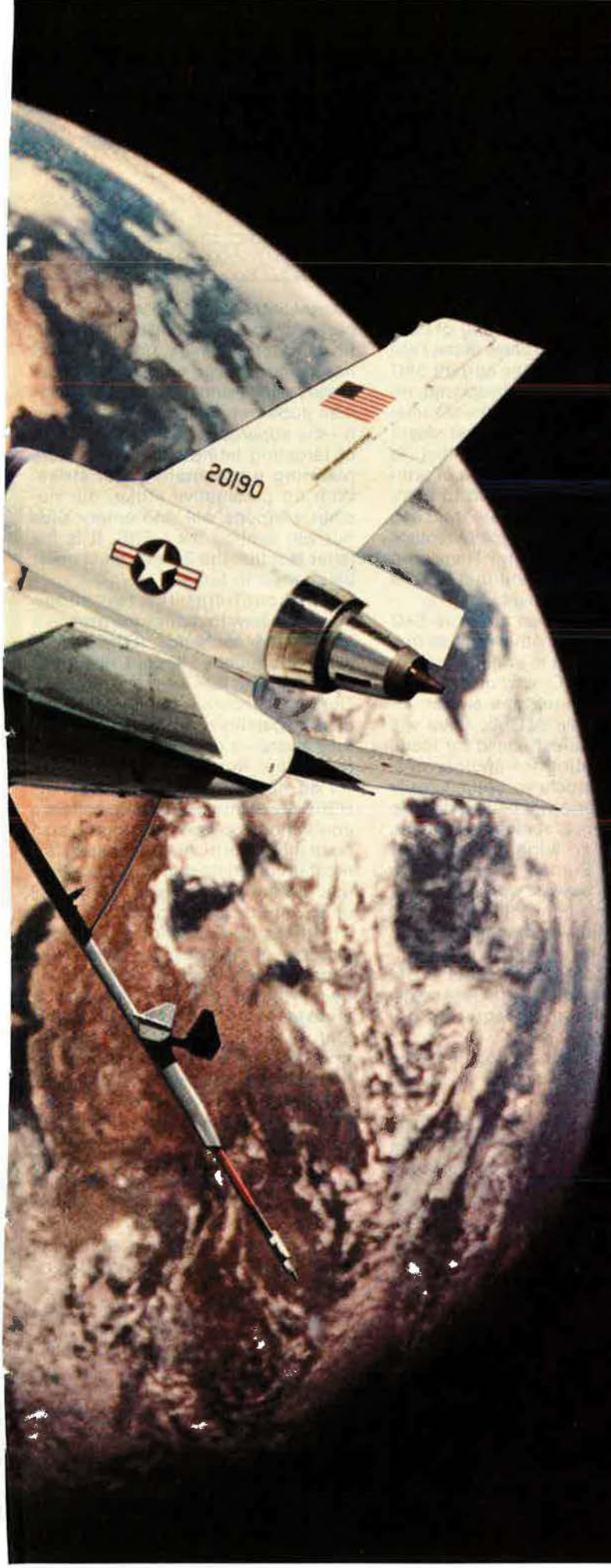
**50 Years of Collins Leadership**

Rockwell International, Cedar Rapids, Iowa 52498. (319) 395-2208.

**Rockwell International**

...where science gets down to business


U.S. AIR FORCE




# THE KC-10 EXTENDS THE ARM OF ALLIED FORCES.

With its fleet of KC-10s, the U.S. Air Force can now for the first time send U.S. and allied fighter squadrons, with support equipment and personnel, to any point on Earth—nonstop, and in full compliance with overflight restrictions. Our air arm arrives sooner. And ready for action.

The KC-10 also works in tandem with other airlifters to help the U.S. Army move its heavy equipment farther, faster, and more efficiently. Runway length and other factors put limits on the payload of the C-5, C-141 and other airlifters. Now these planes can take off with light fuel loads but *full* payloads, then rendezvous with KC-10s shortly after takeoff to take on the added fuel they need en route. The effect is to multiply the productivity of the entire airlifter fleet.

The KC-10. It puts more tonnage in the air faster, for longer distances, at a lower cost.

## KC-10 EXTENDER. PROMISES DELIVERED.

MCDONNELL DOUGLAS

# AIRMAIL

### The Annapolis Connection

"The Annapolis Connection" by Maj. Gen. Robert A. Rosenberg, USAF, which was published in the February 1984 issue of AIR FORCE Magazine, is a most informative article. Nowhere has the history of Naval Academy graduates serving the Air Force been so well documented.

One further twist, however. Since 1971, with the establishment of academic majors at Annapolis, two Air Force active-duty officers have served as chairmen of departments. Col. Joseph Blum served as Chairman of the Weapons and Systems Engineering Department from 1973–76, and Lt. Col. George Peterson—a tenured faculty member at the Air Force Academy—is currently Chairman of the Electrical Engineering Department at the Naval Academy.

As Academic Dean at the Naval Academy since 1971, I find the life of a double agent most exhilarating.

Maj. Gen. Bruce M. Davidson,
USAFR
Annapolis, Md.

I read with great interest the article "The Annapolis Connection," and I was very surprised. I knew it was possible to change branches of the service, but I had considered it improbable to advance to star rank after switching.

I would like to congratulate those who worked so hard to get their star rank. They are a credit to America's armed forces.

Just for the record, though, I think I'll stick with my passion, the Navy. While I respect and admire the Air Force, I still love the sea and the Navy. As an AFA member, I feel that I can grow to understand the needs, missions, and thoughts of the US Air Force. Perhaps I can transmit these discoveries to a few people I know who create problems by claiming that one branch is better than another. That is pure nonsense, as we all know. Together, America remains free and strong. Divided, America falls.

We simply must cooperate, right?

William S. Highfield
Rochester, N. Y.

### Realign Defense Priorities?

It was with a rising feeling of concern that I read the articles in the February '84 issue about the current SAC bomber, the B-52, its proposed replacement, the B-1B, and the MX missile. The bombers are the most recent USAF vehicles of the genre that, in essence, extended the range of artillery. Now they are modified to carry the air-launched cruise missiles (ALCM) that should logically replace them (the bombers). Why? There is no operational requirement that ALCMs be carried by "bombers."

Consider this: If an airborne SAC alert is required . . . this implies that the US is prepared to engage in a nuclear exchange. (Or why order an airborne alert?) Should the aircraft indeed launch their ALCMs, there will be no further military need for them, no "reconstituting for another mission" as one article so optimistically stated. Our world will be in a chaotic state following a nuclear exchange. As my fighter wing commander briefed us in Europe, "Don't plan to return to this base. It won't be here." The need for a conventional military airlift capability will have been blown away. Therefore, why not modify airlift aircraft for a strategic role as ALCM carriers? This would be far less costly than maintaining or acquiring obsolete systems. . . .

As for the MX acquisition, the main justification for it seems to be the prospect that the USSR will have "superhard" command and control facilities and missile silos. Unless the US has made a basic change in its defense policy—and I am sure the American public would like to know about it—the superhard facilities would be of targeting interest only if we were planning a preemptive first strike. With no preemptive strike, our nuclear weapons will find empty silos but will destroy the USSR. It is the latter fact that the Soviets must never be allowed to forget.

What confronts the two superpowers is how to defuse the prospect of a nuclear exchange. If the Soviets wish to squander limited resources on bigger nuclear weapons, so be it. Our only concern is to maintain a nuclear capability of which the USSR is fully aware—a capability to lay waste to "Mother Russia."

I do not believe treaties with the USSR are of much value. I do believe a continuing top-level dialogue would be of more worth. In that context, it is most unfortunate that President Reagan did not opt to attend the funeral of Soviet President Andropov. . . .

Perhaps by not building warheads capable of "successful" first-strike capability, just maybe the Soviets will be convinced we truly do not wish to engage in a nuclear exchange. To this end we should realign our defense priorities, which would not include the ability to destroy superhard facilities with nuclear weapons.

As I said at the outset, a feeling of concern grew with my reading of the articles in the February issue, caused in part by the tone of the articles. They convey the fallacious notion that we can "fight" a nuclear war. Retaliate, yes. Fight, no. There is a significant difference. Let us not be forced to retaliate.

Col. Peter E. Boyes,
USAF (Ret.)
Sacramento, Calif.

**Submissions to "Airmail" should be sent to the attention of the "Airmail" Editor, 1750 Pennsylvania Ave., N. W., Suite 400, Washington, D. C. 20006. Letters should not exceed 500 words and should preferably be typewritten. We reserve the right to condense letters as may be needed. Unsigned letters are not acceptable. Because of the volume of letters received, it is not possible to print all submissions, and none can be returned. Photographs cannot be used or returned. Please allow lead time of *at least* two months for time-sensitive announcements.**

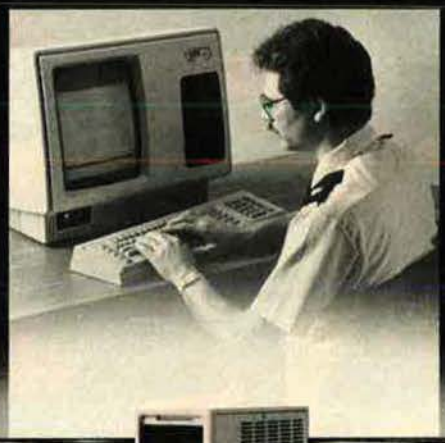
### Deterrence Today

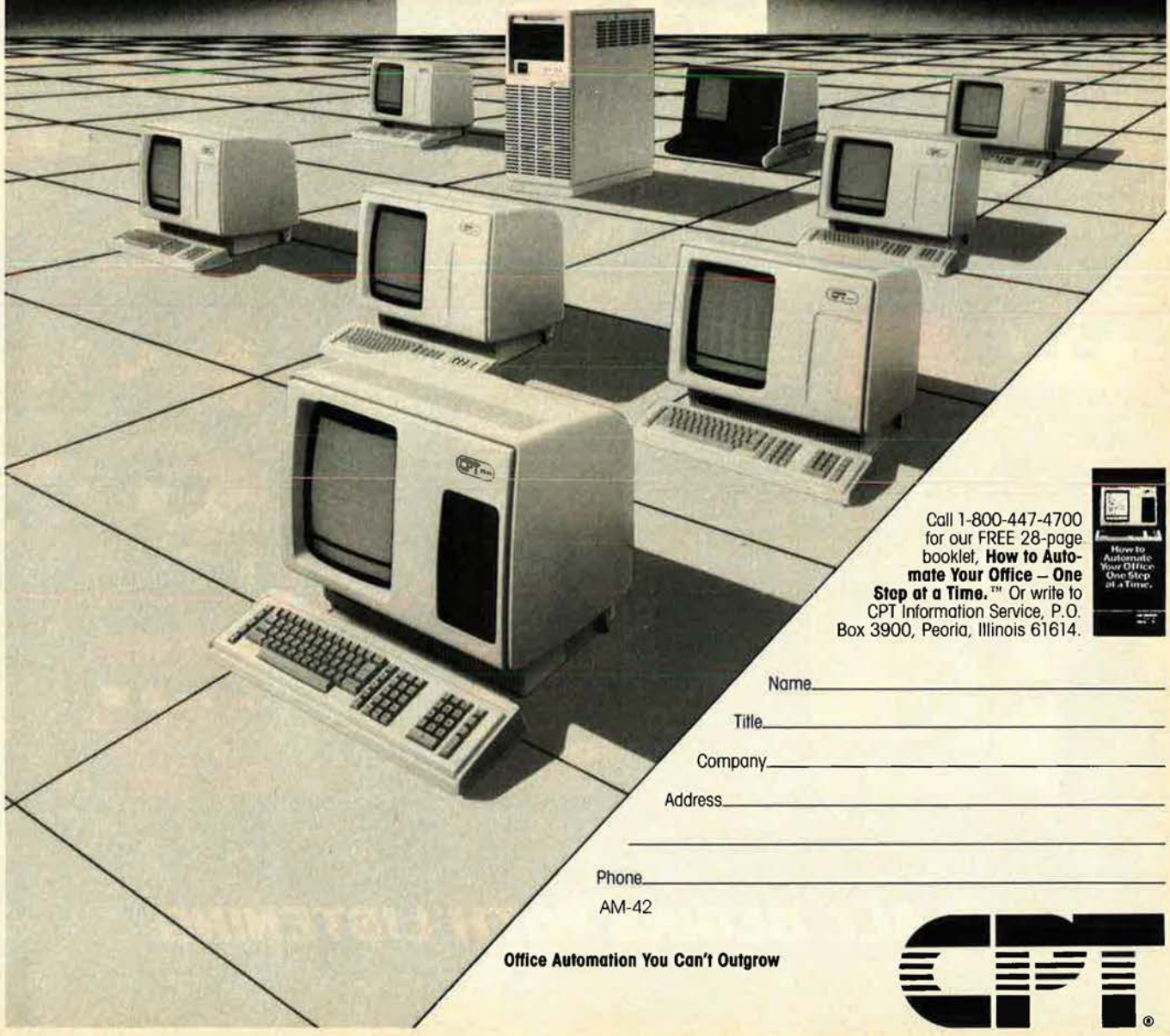
Your February '84 issue special section on strategic forces was very interesting, especially the article "Deterrence Today" on page 40.

# MOUNT A JOINT ATTACK ON PAPERWORK WITH UP TO EIGHT CPT SYSTEMS

Now, with the SRS45 Shared Resource System, up to eight CPT information processors can work together. Without duplicating software, information files, and hardware such as printers.

Space allocation in the central hard disk memory is flexible, providing shared "public" files, plus private files for each operator. System downtime is virtually eliminated, because the workstations share information, not processing power. Each can function independently, even if the central unit goes down. More than ever, CPT has solutions you can't outgrow.








Call 1-800-447-4700 for our FREE 28-page booklet, **How to Automate Your Office – One Step at a Time.**™ Or write to CPT Information Service, P.O. Box 3900, Peoria, Illinois 61614.

Name_____

Title_____

Company_____

Address_____

_____

Phone_____

AM-42

**Office Automation You Can't Outgrow**

CPT®

Commercial Marine Systems
Ship Systems Integration
Navigation and Guidance
Signal Intelligence and Countermeasures
Radar and Fire Control
Simulation and Training
Advanced Technology

# IT ALL BEGINS WITH LISTENING

Command and Control Systems
Traffic Control Systems
Support Systems and Services
Airborne Systems
Communications Systems
Undersea Systems
Militarized Information Processing Systems

SPERRY

**WE UNDERSTAND HOW IMPORTANT IT IS TO LISTEN.**

# AIR FORCE

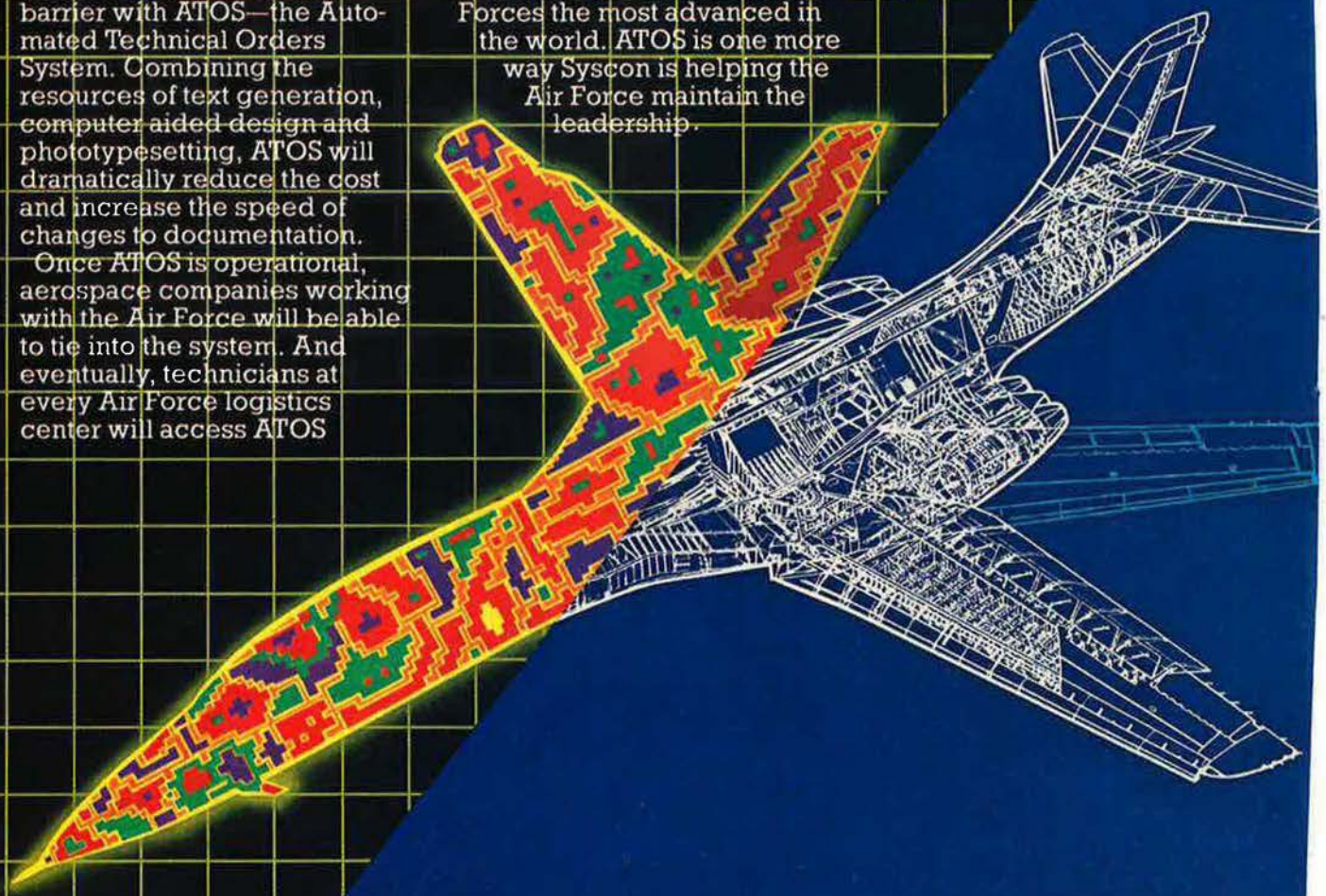
Today, standing in the way of every Air Force advance in technology, is a paperwork barrier.

But the Air Force and Syscon are breaking through that barrier with ATOS—the Automated Technical Orders System. Combining the resources of text generation, computer aided design and phototypesetting, ATOS will dramatically reduce the cost and increase the speed of changes to documentation.

Once ATOS is operational, aerospace companies working with the Air Force will be able to tie into the system. And eventually, technicians at every Air Force logistics center will access ATOS through terminals for instant information on systems operation and maintenance.

Since 1966, Syscon and the U.S. Military have worked as a team to help make our Armed Forces the most advanced in the world. ATOS is one more way Syscon is helping the Air Force maintain the leadership.

SYSCON
CORPORATION
1000 Thomas Jefferson Street, N.W.
Washington, D.C. 20007



# SYSCON

# AIRMAIL

In that article, you said that B-52 support of deterrence has a problem of a shortage of B-52s. Since it probably wouldn't be practical or even possible to build new B-52s for use as ALCM carriers, conventional bombers, or for minelaying, sea-lane defense, and sea-surveillance missions, it might make sense to use a plane that is still in production.

I think that the Lockheed P-3 Orion could do these missions while the B-1B would be used as the penetrating bomber. The P-3 (we could call it a B-3) could be redesigned to fill the previously mentioned mission roles now filled by the limited number of aging B-52s. A cannon could be placed in the tail instead of the submarine-detection equipment now in the P-3, and it could even carry Sparrow or Sidewinder missiles in case it encountered a Russian Bear or Badger bomber far out to sea.

At a time when the US really needs to balance the budget and yet fulfill defense missions, a much less expensive plane, such as the P-3, could be what the Air Force needs. The P-3's four T56 engines are much cheaper to feed than the eight J57s of the B-52G or eight TF33s of the H model. Even though the P-3 isn't as fast as a B-52, speed isn't really critical since we would have the B-1B for missions requiring speed.

I don't know if the Air Force would ever consider such a thing as a P-3 to a B-3, but if I were to have a say in the matter, I'd say we should at least investigate the P-3. I know that Lockheed would just love to build them. After all, the USSR is still building the Bear to handle long-range missions over water and to carry ALCMs.

I hope something is done to fill the B-52 shortage gap before it's too late. This is something USAF should have started ten or fifteen years ago, but who would have thought that there wouldn't be a replacement for the B-52 already flying?

Gary M. Beasley
Crescent, Okla.

Your article "Deterrence Today" describing the role of SAC presented an excellent overview of the various upgrades of SAC mission capabilities to meet today's challenges.

It's ironic that once you sort out the acronyms and load and cock the aircraft, it still takes cops, on foot, to guard the sophisticated systems. Didn't we do that thirty years ago?

Capt. Mike DeCapua, USAF
Nashua, N. H.

**Academy Flying**

Many thanks for Bob Stevens's excellent "There I Was . . ." in the February '84 issue on the Air Force Academy's flying programs.

As much as we'd like to take all the credit for the Academy's airmanship activities, however, we in the 557th Flying Training Squadron must confess that the soaring and parachuting programs are actually the responsibility of the newly formed 94th Airmanship Training Squadron, formerly known as the Commandant's Airmanship Division. After all, domestic tranquillity on the airfield is extremely important considering our side-by-side operations and as many as 200 sorties a day with 100 or so jumps thrown in for good measure. The 94th does all the exotic gliding and jumping stuff. We in the 557th, of course, do the real work—providing our "firsties" (senior cadets) with their first taste of Undergraduate Pilot Training in the T-41. It's tough duty, but someone has to do it, right?

Seriously, Mr. Stevens beautifully captured the essence of the flying activities at the Academy Airfield. All of us engaged in the airmanship programs here—on both sides of the field—appreciate the recognition.

Lt. Col. Monroe S. Sams, Jr., USAF
Commander, 557th FTS
USAF Academy, Colo.

I had the pleasure of meeting Bob Stevens during his tour of the Academy. At the time, I was the 557th Flying Training Squadron operations officer. I enjoyed our talk and really thought he did a great job depicting life at the Academy Airfield in the February '84 issue. I'm afraid, however, that we did our job too well during the interview.

The 557th FTS is responsible *only* for T-41 training. The 94th Airmanship Training Squadron, previously known as the Airmanship Division, has the responsibility for soaring and motorglider and all parachute training. Last year the 94th flew more than 29,000 glider sorties, jumped more than 10,000 times, and acquired the newest aircraft in the Air Force inventory—the TG-7A motorglider. We are the world's largest soaring and free-fall parachuting activity. Beginning this summer, all third class cadets will soar as a mandatory portion of their curriculum. This will increase our sorties to over 30,000 per year.

Bob's work is always the best—his humorous but accurate view of our daily lives is a highlight of AIR FORCE Magazine.

By the way, I must admit that I do have a vested interest in writing you. In December, "There I Was . . ."—selected to command the 94th!

Lt. Col. James A. Shaw, USAF
Commander, 94th ATS
USAF Academy, Colo.

**Oops!**

Your attention is invited to page 93 of the February '84 issue of AIR FORCE Magazine.

After being retired sixteen years, I finally made the big time—my picture appeared in AIR FORCE Magazine. Hot damn! But wait a minute—my name is not Clifford J. Craven. Is it possible that AIR FORCE Magazine made a booboo? Hard to believe!

Col. John T. Allen,
USAF (Ret.)
Universal City, Tex.

• *Hard to believe, maybe, but true. We regret the error.*—THE EDITORS

**Operation Urgent Fury**

I applaud your efforts at covering Operation Urgent Fury under very difficult circumstances—the chief problem being that you were working with incomplete information at the time, information that we in Public Affairs were unable to furnish early on in the operation.

It is, however, important to set the historical record straight. The article "Blue Christmas Coming Up" in the January '84 issue had several incorrect or misleading statements. I assure you that putting things in proper perspective is very important to the folks here at Pope AFB and the 317th Tactical Airlift Wing, as they believe their massive effort to support the operation has been largely overlooked.

You mentioned that the 1st Special Operations Wing at Hurlburt Field, Fla., flew the assault on the island. While it is true that the 1st SOW led the assault, the bulk of the assault force came from the 317th TAW. Pope AFB aircrews airdropped and airlanded Rangers from eighteen airplanes—almost three-quarters of the initial assault force. A number of our crew members will be cited for their outstanding efforts.

Before noon of the first day, Pope had deployed more than 600 of the 800 Air Force people on Grenada and Barbados. Pope people provided all of the maintenance, weather, mobile aerial port, and finance and personnel support for the operation as well as most of the C-130s, ground equip-

ment, tactical airlift aircrews, command and control people, supply, transportation, tactical aeromedical evacuation, and combat control support. Our security people also constituted a large part of the security force.

From Barbados, 317th TAW C-130s flew around-the-clock tactical airlift shuttle missions into Grenada. They carried in the entire multinational force and the bulk of reporters. The planes returned with wounded, captured weapons and ammunition, and the Cuban detainees.

The effort at Pope AFB was no less astonishing. By November 7, Pope had handled more than 13,000 passengers and 5,000 tons of cargo destined for Grenada. The base launched thirty-four C-5s, 371 C-141s, and 234 C-130s (103 of these were our own planes). There were airplanes occupying every conceivable parking space at Pope—and we handled all of this traffic with no accidents and a ninety-nine percent launch reliability rate!

I could, of course, go on and on. But I think you can get the picture. While people from throughout the Air Force had roles to play in the operation, no unit and no base was more heavily tasked than the 317th TAW and Pope AFB to support Urgent Fury.

So when our people here at Pope saw one of their C-130s misidentified in one of the photos included in the article, they were understandably upset. The plane was identified as an MC-130E when this photo was actually taken after all of the 1st SOW Combat Talons had left the theater. They were even more concerned to find the 317th TAW and Pope AFB hardly mentioned in the article.

Again, let me say I think you did a good job with the information available at the time. But for the benefit of the large number of troops at Pope AFB who did such a magnificent job in Operation Urgent Fury, I want to set the record straight.

Capt. Kathi C. Blevins, USAF
Chief of Public Affairs
Pope AFB, N. C.

**Totally Integrated Airplane**

I found your January '84 article "Toward the Totally Integrated Airplane" most informative and refreshing. As one who has spent his working career in the defense industry, it is encouraging to read that the pilot remains the focal point in an integrated weapon system.

The article illuminates effectively that a pilot's physiology and powers of concentration are strained by his role commanding a myriad of systems. For this reason, I believe more emphasis should be given to the pilot's environmental comfort. Providing a maximized, efficient, controlled environment that reduces the potential for hot- and cold-induced physical stresses on the pilot and the avionics that support the aircraft mission is critical to the mission's success.

Much is being done in this area; however, it is deserving of greater attention in dealing with the subject of the totally integrated aircraft.

D. Anthony Petkelis
President, Fairchild Control System Co.
Manhattan Beach, Calif.

# AIRMAIL

**Fantastic Colonel Day**

I've just finished reading "The Long Road to Freedom," the "Valor" article by John L. Frisbee in the February '84 issue of AIR FORCE Magazine. It is a story about a fantastic individual, Col. George E. "Bud" Day.

Mention was made of Colonel Day's bailing out of a burning jet fighter at 300 feet in England. I was there when it happened and thought you might be interested in the story, as I remember it. I hope that Colonel Day will forgive me if my recollection of the details after twenty-seven years is somewhat hazy.

On that day, I was on duty in the base fire department at RAF Woodbridge in England, assigned as a foam turret operator on a crash truck. I and the rest of my crew were standing in front of the station watching a flight of two F-84Fs approaching Runway 09. The number-two ship was slightly behind, above, and to the left of number one. Number one landed without incident.

Number two began to turn left to go around to get back in the pattern for touchdown. As the ship turned left over the forest on the north side of the runway, the engine exploded and began to burn. We saw the pilot punch out and thought there was little chance he could survive, as he was only at about 300 feet. We lost sight of the pilot as he plummeted into the forest, his partially opened parachute trailing behind him.

My crash truck was the second one to arrive at the crash scene. We extinguished the fire and began to search for the pilot. He was finally located in a tall pine tree. He was alive and suffered only minor injuries. He was retrieved from the tree and taken to the hospital. At the time of his rescue, he mentioned what a fine vantage point he had for watching the entire firefighting operation.

After Colonel Day's (he was a first lieutenant or captain then) release from the hospital, he returned to the Woodbridge fire station to thank us for our efforts in fighting the fire and rescuing him. He took the time to "shoot the breeze" with us. He told us that he had been performing a cross-country flight check on the pilot in the number-one aircraft when the incident happened. When he left us, we felt that we had met a truly fine officer and a gentleman.

I realize that in view of Colonel Day's later accomplishments, this story borders on being trivial. However, it is a story about a person whom I've never forgotten in all these years and one I have told repeatedly since it happened. I thought the other readers of your magazine might also be interested in the story.

Colonel Day has shown that he is made of the stuff that we all hope we have in ourselves.

CMSgt. Bruce L. McLaren, USAF
Mascoutah, Ill.

**First Raid on Berlin**

I am writing about John Frisbee's well-written (as usual) article in the January '84 issue, "Crisis in the Cockpit"—a story that most old Eighth Air Force members recall very well.

Being a member of the 95th Bomb Group, I must take exception to the statement that Lieutenant Morgan participated in the first Berlin daylight bomber raid on March 6, 1944. The *first* raid was done by the 95th and 100th Bomb Groups on March 4, 1944, and a Unit Citation was awarded for it.

On March 6, 1944, the 95th flew again to Berlin, but this was the second raid, not the first. It was on the second raid that Lieutenant Morgan was evidently shot down and taken prisoner.

Lt. Col. Alexander M. Cochran, USAFR (Ret.)
Heathsville, Va.

• *Reader Cochran is correct. We regret the error.*—THE EDITORS

**Troop Carriers**

They flew gliders and unarmed transport planes. The armor was a flak helmet and a flak vest, and if you could scrounge an extra one, you sat on it. No self-sealing fuel tanks anywhere, and their firepower consisted of the .45-caliber automatic in their

shoulder holsters. Not many decorations, many casualties, and no rotation plan to speak of. Most of the aircrews that went over in 1942 were still there when the war ended in Europe in 1945.

Who were these jokers? Well, the fighter jocks and the bomber drivers called them "trash carriers."

There were about twenty-three troop carrier groups overseas during World War II. While there is very little in the way of records or history on troop carrier contributions during WW II, our overseas friends have not forgotten. The Dutch are now starting to build an Airborne Museum as a memorial to the 9th Troop Carrier Command and the 82d and 101st Airborne Divisions. The Arnhem Veterans Club is made up of British, Polish, and Dutch veterans who survived the Battle of Arnhem. They are now trying to locate the American troop carrier crews who dropped them.

After forty years, many of the old troop carrier squadrons and groups are trying to locate former members to form reunion associations. Some are planning tours to Europe for the fortieth anniversary of D-Day. During the past seven years, the WW II 315th Troop Carrier Group Association has been able to locate more than 750 of our former members. During this time we have received many letters from other former troop carrier personnel wanting information on their old units.

I now have contacts and addresses for twenty of these WW II troop carrier groups. I would be most happy to send a copy to any former troop carrier who will send a note on his service and a *self-addressed, stamped envelope* to the address below.

Robert L. Cloer
1417 Valley View Dr.
Yuba City, Calif. 95991

**Cross-Country Biking**

I am planning to bicycle along the 1976 Bicentennial Bike Trail from Portland, Ore., through the great state of Idaho, along the Lewis and Clark Trail in Wyoming, across the continental divide in Colorado, across the wheat fields of Kansas and through the southern tip of Illinois, over the rolling hills of Kentucky to finish in Yorktown, Va., around the first of September after eighty or ninety days of riding, camping, and exploring our grand country in a leisurely and reflective journey.

Who of you old soldiers and AFA members, along with your friends and relatives, would care to join me? It will be a real do-it-yourself campout—pay your own way and share in friendship, adventure, and the sweet taste of success as we wade into the Atlantic Ocean. We should end the trip in good physical shape for the skiing season, and I might have a plan for that also.

Interested souls (no discrimination as to age, sex, race, or political persuasion) are invited to contact me to discuss the trip more specifically.

Col. Joseph Schreiber,
USAF (Ret.)
3984 Preamble Pl.
Boise, Idaho 83706
Phone: (208) 383-9016

**B-58 History**

I've finally completed enough of my other writing projects to embark on one that I've wanted to do for a long time—a definitive history of the Convair B-58.

As is often the case with projects of this type, there are still items I need for reference. Among the many items are photos. I am trying to assemble a collection that includes at least one photo of every B-58 built. To date, I've achieved half my objective, but that is not nearly good enough.

To complete my collection, I would like to borrow photos from any readers who have pictures of B-58s. Slides or photographs are suitable. I would like to keep anything loaned for a minimum of sixteen weeks. All photos will be returned promptly following publication and all who contribute photos that are used will receive a free copy of the book.

In the more esoteric area, I am also looking for photos and information concerning the four ALBM launches that took place at Eglin AFB, Fla., the General Electric J93 test-bed modification, the Hughes SLAR pod, the Hughes Big Nose test-bed modification, any verification that two B-58s were painted in temporary camouflage at Eglin AFB during the mid-1960s, and information and photos of unusual modifications or test programs that took place during the course of the B-58's operational career.

I would like to emphasize that all contributions are welcome. This book is, however, primarily a history of the airplane. Only secondary emphasis is being placed on the people. Unusual anecdotal material will be considered for publication if it is particularly unique.

I am shooting for a late summer release date, so any responses should be in my hands as soon as possible. Of course, all loaned material will be handled with care.

# GE engineers feel the best Defense Satellite Communications System should also defend one important group:

# The taxpayers.

It's no easy job to save money and improve technology at the same time.

But General Electric engineers are doing just that on DSCS III. By creating new solid-state amplifiers, they are extending the life of the DSCS communication system — and that saves money!

But there's more. General Electric engineers are also at work on EHF transmitters and the adaptive nulling processor. Our goal is the same: better technology at a better price.

The fact is, in the forty years GE has been working on government space programs, we have always found ways to improve technology while conserving the country's resources.

Leading from the start... and working on the future.

Space Systems Division, Valley Forge, PA.



162-104

# AIRMAIL

Please contact me at the address below.

Jay Miller
Publisher, Aerofax Inc.
P. O. Box 5337
Austin, Tex. 78763

**Parachutes and Paul Meek**

Information and photographs are needed for historical purposes regarding Paul Meek, who played a very important role in the development of parachutes. Paul died January 22, 1970, in Tuscola, Ill.

Meek enlisted in the Army Air Corps at the age of sixteen and became a parachute rigger at Chanute Field. He was the first man to make a high-altitude parachute jump, dropping from a height of 18,000 feet in Mississippi in 1925. At the end of his enlistment he returned to Illinois, but in 1942 returned to the Army Air Corps and served in North Africa, Sicily and Italy, and England. He again worked as a parachute rigger, and developed a combination parachute and liferaft for fighter pilots, which he demonstrated by jumping into the Adriatic Sea near Bari, Italy. On the basis of this accomplishment, Meek received the Legion of Merit on the recommendation of General Jimmy Doolittle.

More information on Paul Meek is needed for recognition by the Historical Society in his hometown. If anyone has any information on Paul Meek—especially a photograph—please contact me at the address below.

Lt. Col. Andy M. Kmetz,
USAF (Ret.)
1715 W. Haven Dr.
Champaign, Ill. 61820
Phone: (217) 356-6186

**Eighth Air Force Rescue**

In connection with the preparation of a fact-fiction book, I am interested in getting in touch with Army Air Forces veterans who might have knowledge in any of the areas listed below.

I'd like to hear from any Eighth Air Force intelligence unit personnel who were stationed in the area of Ipswich in the fall of 1944 and winter of 1945.

Also, I'd like to hear from any Eighth personnel who are knowledgeable about the procedures used to report and search for missing aircraft that were thought to have come down in the English Channel or the North Sea. Any Air Force air/sea rescue personnel who might have been involved in such searches and who can brief me on the procedures, equipment used, and liaison with the English rescue units are invited to contact me.

Lastly, I would like to correspond with Air Force personnel who were trained in the operation of the British Westland Lysander aircraft used to deposit and recover agents behind enemy lines in Europe.

Hamilton Darby Perry
The Franklin Library
800 Third Ave.
New York, N. Y. 10022



**448th Bomb Group Ass'n**

The 448th Bomb Group Association, whose membership flew B-24 Liberators out of England during World War II, is seeking former airmen who served in the UK.

Many do not know that there is such an organization. The Association held its thirty-sixth reunion this past May and June in Norwich, England.

The 2d Air Division Association, of which the 448th Bomb Group is part, will hold its thirty-seventh annual reunion this October in Palm Springs, Calif. Former members are invited to join this Association (annual dues are $10). If you join, ask for information about the 448th Group granite memorial that is being built now in England for dedication on June 9, 1984.

Lt. Col. Leroy J. Engdahl,
USAFR (Ret.)
1785 Wexford Dr.
Vidor, Tex. 77662

**Old Hickory Squadron**

The "Aero" Squadron at Berry Field at Nashville, Tenn., is planning to publish a pictorial history book of their Air National Guard unit from its beginning in 1917 to the present.

The 105th Squadron was the first Air National Guard squadron in the United States but was the third to be federally recognized. From DH-1 de Havillands, JN-6 Jennys, P-47 Thunderbolts, and RF-84 Thunderflashes to C-97 Stratofreighters, C-124 Globemasters, and C-130 Hercules, the 105th Squadron has a long and proud history.

It is our belief that the best photos and records of the squadron's early years are in the possession of private citizens who are former members of the "Old Hickory" Squadron.

Photos or documents loaned to the squadron will be copied and re-

turned. All loaned and donated items will be acknowledged if published.

Please contact the address below.

1st Lt. Tim Childers, USAF
105th TAS
P. O. Box 17267
Berry Field, Metro Airport
Nashville, Tenn. 37217

**Gowen Field**

I would like to locate anyone who has served or has been stationed at Gowen Field near Boise, Idaho—especially those who were there between 1941 and 1954. The purpose is to establish a permanent display that tells the history of the field from 1941 to the present.

During World War II, Gowen Field was used as a training field for B-17 and B-24 bombers. The predominant bomb groups stationed there were the 42d and the 29th. There were, however, many more that were there for a brief time. During the hustle, there was not much thought given to saving small items and memorabilia for historical purposes.

We would appreciate any help from anyone who would be interested in helping us preserve our history.

Paul G. Nutting
536 North 7th St.
Payette, Idaho 83661

# AIRMAIL

**British Training in Texas**

I am attempting to trace the whereabouts of former World War II Royal Air Force pilots who were trained at the No. 1 British Flying Training School at Terrell, Tex., from June 1941 to September 1945. I am also looking for the American civilian flying instructors and staff who operated and ran the school.

Those of us who were trained at the school are very proud of the fact. We are now forming a No. 1 BFTS Association comprising former students, American instructors, and staff. We would like to hear from anyone who was involved with this flying training organization.

L. James Freeman
"Hirundine"
Church Lane, Timberland
Lincoln LN4 3SB
England

**B-24 *Little Chum***

After all these years, is it possible that someone out there can provide to me any information about a B-24 named *Little Chum*?

My crew named her in Topeka, Kan., the latter part of June 1944, and we transported her to Wales in July 1944. Upon landing in Wales, we were directed to leave the aircraft and all paper work because she was needed immediately somewhere in England.

I would appreciate any information any readers may have available.

Col. James E. Rutherford,
USAF (Ret.)
5238 W. Shangri La Rd.
Glendale, Ariz. 85304

**Fifteenth Air Force Vets**

I was shot down near Linz, Austria, on July 25, 1944. I am planning a trip to Austria this spring or summer to revisit the places I passed through in Austria after I reached the ground. I will also visit Vienna and other places of interest in Austria, and perhaps other nearby countries.

I would like to hear from any Fifteenth Air Force WW II veterans who might be interested in making such a trip or who may have any comments about it.

Milton Radovsky
10710 Lockridge Dr.
Silver Spring, Md. 20901
Phone: (301) 942-7220

**Where Are You?**

I am trying to locate six members of our B-24 bomber crew who were stationed at Bungay, England, with the 446th Bomb Group, 707th Bomb Squadron, during 1943 and 1944. Three of us on the crew (and our aircraft crew chief) plan a reunion for October 1984, and we would like to locate and invite the others to join us.

They are: Albert V. Pearson, John D. Madge, Paul H. Sallee, Carl W. Salminen, Albert L. Cochran, and George S. Blank.

Would anyone who has information about any of these individuals please contact me with details that might help me in my search?

Col. Thurman Spiva,
USAF (Ret.)
8520 Hans Engel Way
Fair Oaks, Calif. 95628

I would like to hear from anyone who was associated with the 3d Photo Recon Squadron, 311th Photo Wing (mapping and charting) in the Asiatic-Pacific Theater during 1944–45.

Also, I am interested in anyone who might have known SSgt. Edward E. Kelley, photogunner, who was lost 400 miles southeast of Tokyo while returning from an aerial reconnaissance mission over Japan.

Any information available would be greatly appreciated. Please contact me at the address below.

Stephen D. Kelley
857 Federal Furnace Rd.
Plymouth, Mass. 02360

I am looking for anyone from the 462d who might have information about any one of my fellow crew members who flew with Albert Abranovic aboard *Ramp Tramp* in the CBI theater and the Marianas.

Please contact me at the address below.

Paul D. Myers
511 Sunset Way
Juno Beach, Fla. 33408

I am interested in contacting Otto McIver, who was a major in 1944, relative to a medium-bomber history.

Should any readers have information on his whereabouts, I would appreciate being contacted.

N. L. Avery
2231 Bobcat Trail
Mount Shasta, Calif. 96067

**Collectors' Corner**

I am trying to locate a picture of a Northrop F-15A, the photo version of the P-61 Black Widow.

In May 1947, I picked up one at Wright-Patterson AFB, Ohio, and flew it to Olmsted AFB, Pa. It was assigned to the 4149th Electronics Squadron at Olmsted and was reassigned, with the squadron, to Griffiss AFB, N. Y., about a year later. The squadron was later designated the 3135th Electronics Squadron.

If anyone can help, please contact me at the address below.

Lt. Col. Ted E. Hoffman, USAF (Ret.)
HC74, Box 61C
Chadron, Neb. 69337

I'm collecting Air Force, Army, and Army Air Forces insignia, old and new. I'm especially interested in World War II "T" chevrons and prop and wing chevrons.

Anyone who is interested in selling such items is asked to contact me at the address below.

Richard T. Elrod
2204B Lawson Dr.
Charleston AFB, S. C. 29404

I am a military insignia collector who is looking for the unit crests for some World War II units.

These include the 27th Bomb Squadron, the 93d Bomb Squadron, and the 3d, 17th, 20th, and 21st Pursuit Squadrons.

These are Army Air Corps units that were stationed in the Philippines on December 7, 1941. Any help in obtaining crests of these units would be appreciated.

Marvin Taylor
66 Villa Dr.
Clearfield, Utah 84015

I would like to obtain a copy of *The Aviation Art of Frank Wootton*, an out-of-print, softcover art book about the works of this British artist. It was published in 1976 by Peacock Press of Bantam Books.

If someone knows where there is an available copy, I would greatly appreciate having details about its condition and price. Locating a copy would bring much pleasure to this former B-17 pilot.

Harold C. Demoody
11725 Indian Ridge Rd.
Reston, Va. 22091

I am seeking information on Air Force strategic missile squadrons activated in the late 1950s and early 1960s. The following units are of particular interest: 549th, 550th, 556th, 564th, 565th, 567th, 568th, 569th, 576th, 579th, 705th, 848th, 849th, 850th, and 851st Strategic Missile Squadrons.

Anyone having information on or patches from these squadrons is asked to contact me at the address below.

Donald R. Speir
115-2 Chevy Chase
Minot AFB, N. D. 58704

I have a mint-condition collection of AIR FORCE Magazine going back some twenty-five years that I intend to donate to a major academic library or other such institution that would find them useful.

Any such institution interested in my collection should contact me at the address below.

Lt. Col. Daniel A. McGovern, USAF (Ret.)
9950 Wilbur Ave.
Northridge, Calif. 91324

I have been trying for several months to find a picture of the A-26 *Tom Swift's Flying Machine*, which I flew in World War II. I've had no luck in getting this picture.

In particular, I am looking for a photo taken of this aircraft during the 1945 Eiffel Tower Display.

If you have or know of such a photo, please contact me at the address below.

R. H. Hackley
1504 Belmont Dr.
Orlando, Fla. 32806

# Rockwell International know-how: It goes into the B-1B aircraft. It's in everything we do.

The design and building of the U.S. Air Force's B-1B Long Range Combat Aircraft represents one of the world's demanding technological challenges. The aircraft will be versatile, have intercontinental range, carry large and diverse payloads, and be capable of penetrating formidable defenses.

Flight testing and production are ahead of schedule, with delivery of the first production aircraft scheduled for 1984.

Only a company with the know-how to combine advanced technology with outstanding engineering and management skills can successfully meet this unprecedented challenge. That know-how goes into our aerospace business and into everything we do at Rockwell.

*In electronics:* where we're the Navy's prime supplier of Inertial Navigation Systems which provide Fleet Ballistic Missile and Attack Submarines with highly accurate position information.

*In the automotive industry:* where nearly every heavy-duty truck and passenger car built in the U.S. is equipped with advanced-technology, cost-efficient Rockwell components.

*In general industries:* where our Miehle products provide printers with some of the most technologically advanced sheet-fed presses and bindery equipment in the world.

We're an $8 billion company where science gets down to business in four diverse areas. And that diversity has helped us achieve eight consecutive years of increased earnings and impressive growth.

If you are interested in any of our products or want to learn more about us, write: Rockwell International, Department 815AF-2, 600 Grant Street, Pittsburgh, PA 15219.

**Rockwell International**

...where science gets down to business

Aerospace/Electronics
Automotive/General Industries

# IN FOCUS...

# The Dual-Role Eagle

By Edgar Ulsamer, SENIOR EDITOR (POLICY & TECHNOLOGY)

*USAF chooses F-15E as derivative fighter, reaffirms need for ATB rather than more B-1s, however modified.*

Washington, D. C., March 5

Although initially contested in the Pentagon by advocates of "high-tech" unmanned standoff weapons, the Air Force won OSD approval in February for its Dual-Role Fighter program and announced that 392 two-seat F-15s would be procured and modified for this purpose. The F-16 was the only other competitor in this source selection. In announcing the decision, Air Force Chief of Staff Gen. Charles A. Gabriel explained that these aircraft, previously programmed for procurement by the Air Force, would be modified by McDonnell Douglas Aircraft Corp. at an estimated cost of about $1.5 billion and begin to enter the inventory in 1988.

This modified aircraft, designated the F-15E, will incorporate advanced avionics and weapons-carriage provisions, flight-control improvements, and minor structural changes to accommodate increased operating weights. A key element of a comprehensive modernization program for tactical airpower—known as the tactical fighter roadmap—the F-15E is "vitally needed to redress our tactical forces' limited ability to operate over long ranges in adverse weather conditions, day or night," according to General Gabriel. He added that at present "only the fully committed and aging F-111 has that capability. The F-15 Dual-Role Fighter will augment the F-111 in performing long-range, high-payload missions at night and in adverse weather."

The modified aircraft will retain its nonpareil air-to-air characteristics combined with enhanced performance in around-the-clock, air-to-ground operations at greater ranges and with increased weapons loads. Integration of advanced avionics, controls, and displays enables the F-15E to penetrate enemy defenses at low altitudes as well as to detect and destroy both fixed and moving targets under all weather conditions. The aircraft will carry a variety of air-to-surface munitions.

The Air Force's decision on the Dual-Role Fighter was preceded by comprehensive flight evaluations and analyses of derivatives of the two competing designs—the F-15 and F-16. General Gabriel pointed out that "while the F-15 demonstrated clearly superior dual-role mission capabilities, the modified F-16 with its 'cranked-arrow wing' demonstrated high potential for follow-on development." The Air Force, therefore, will evaluate the F-16XL further, including additional flight testing, along with other promising technologies for future application to a single-seat advanced version of the F-16 Fighting Falcon.

## The Unsinkable ATB Rumors

With Congress back in session, behind-the-scenes maneuvering and lobbying to influence the Administration's decision to hold acquisition of the B-1B bomber to 100 aircraft and, by the early 1990s, to begin deployment of the Advanced Technology Bomber (ATB, colloquially referred to as "Stealth") have once again moved into high gear. Media reports abound alleging a congenital Air Force bias toward buying additional quantities of B-1Bs or follow-on models incorporating a degree of Stealth technologies rivaling that of ATB. A complementary whisper campaign on Capitol Hill alleges that by grafting onto the present configuration of the B-1 the Stealth technologies developed by the losing contractor teams in the ATB competition—involving a more or less conventional rather than the "flying wing" configuration chosen for ATB by the winning contractor team—nearly the same low-observable characteristics could be attained at much lower cost.

It is somewhat ironic that specific percentages are being claimed for the performance of such a "B-1C" relative to that of ATB. The latter has not yet been fully developed and, of course, not flight-tested, with the result that its ultimate performance is not yet fully established. Those who favor buying additional quantities of B-1s also invoke the need for bolstering and modernizing the Air Force's ability to support the Navy's sea-control mission and claim that this can be accomplished best by buying more B-1s.

While there may well be cogent arguments for extending the B-1 buy, to parade them around Capitol Hill at a time when program stretch-out has become the new catechism of the budget-cutters might hurt the B-1B program as much as the ATB. When the Carter Administration terminated the B-1A program almost seven years ago, it sought to justify this action largely by talking up the operational and technological merits of the "Stealth" bomber. Prominent military and technical experts concurred at the time. As a result, there is a residue of good will toward ATB on Capitol Hill that might cause a backlash against the B-1—especially the multiyear authorization facet of the program—if serious doubt is created about the Air Force's intent to move out smartly on the "Stealth" bomber.

USAF's Vice Chief of Staff, Gen. Lawrence A. Skantze, affirmed unambiguously at a special Pentagon press conference in February that the Air Force and the Department of Defense support the "two-bomber program," that the Air Force is giving "no consideration" to buying more than 100 B-1Bs, that this policy was firm and would continue, and that he expected the first ATBs to enter the operational inventory in the early 1990s. Stressing that both the B-1B and the ATB programs were on schedule and had the full support of the Air Force, he said that "both of them are proceeding well and satisfactorily."

There is no evidence that the ATB program will slip behind USAF's schedule to introduce the aircraft into

# Titan II. Starting to make waves in the U.S. Navy.

Over 9,000 of Turbomach's original Titan turbines have already proven their reliability in use by the Navy, Air Force and Army. That's one of the reasons why the Navy has just ordered more than 700 new Titan II start carts for use through the 1990s.

Cranking out a hefty 300 horsepower, the Titan II JASU (Jet Aircraft Start Unit) represents the state of the art in small turbine technology.

Titan's proven turbine reduction gear and advanced micro-electronic controls minimize maintenance and increase mission availability. Doors on the Titan JASU have been designed for easy access. Modular construction simplifies maintenance and repair. And most importantly, these features help achieve low life-cycle support costs for the Titan II JASU.

Remember the names Turbomach and Titan II.

They'll both be making waves in reliable starting power for years to come.

Write or call Mark Gramlich at Turbomach for more information.

Turbomach

DIVISION OF SOLAR TURBINES INCORPORATED

4400 Ruffin Road, Dept. AF/San Diego, California 92123/(619) 238-5754

Ⓒ is a Trademark of Caterpillar Tractor Co. Turbomach, Titan, and Titan II are Trademarks of Solar Turbines Incorporated.

VHSIC.
The Westinghouse team is putting VHSIC to work in brassboards for airborne, surface, and armored vehicle systems.

VHSIC.
The Westinghouse team is putting VHSIC to work with an approach applicable to over 80% of all DoD's targeted electronic requirements.

VHSIC.
The Westinghouse team is putting VHSIC to work in signal processing for Radar, EW, E/O, Communications, and $C^3I$.

VHSIC.
Only the Westinghouse team is putting VHSIC to work with a building block approach including Ada programming, a universal chip set, a common module family, and multiple systems application potential.

**You can be sure . . .**
**if it's Westinghouse**

the inventory in the early 1990s, he said, adding that the program is "very robustly funded." The program schedule formulated several years ago is realistic and avoids undue technological risks. He refuted claims that the Air Force laid out the schedule in a way that caused stretch-outs by not allocating enough money: "The problem is the technologies were so new to us, and our understandings were so thin of how you'd use those technologies and how you apply them," that throwing additional money at the ATB program "would not have bought us anything."

Asked by this reporter about the feasibility of substituting a derivative of the B-1B optimized for stealthiness for ATB, General Skantze explained, "What you have to appreciate is that if you want to maximize the advantage of Stealth technology, you have to begin with a clean sheet [of paper], with a new design. If you take an existing aircraft—I don't care whether it's a B-1 or an F-15 or an F-111"—its radar cross section can't be reduced to the level of ATB because its existing geometry imposes "fundamental limitations."

General Skantze acknowledged that the program schedule creates a "severe phase-down problem" by going from a proposed authorization request for forty-eight aircraft in FY '86 to zero in FY '87, but countered that "we made a conscious decision to acquire that B-1B force of 100 as efficiently as we could. Thus, we build forty-eight in the last year."

The Air Force's rationale for a two-bomber program—adopted by the Administration as national policy in October 1981 following an intensive OSD review—centers on buying a limited number of B-1s "rapidly in the most efficient fashion" and fielding this force by 1988, while at the same time setting the stage for ATB, which promises "much more of a dramatic capability in terms of stressing Soviet defenses" over the long term, according to General Skantze. By building two different bombers, each of which requires specialized Soviet defenses, the Air Force expects to compound Moscow's air defense problem "synergistically," he added. Ancillary benefits of the two-bomber approach include the ability to maintain "a modicum of competition" and to "hedge" if one or the other type of bomber runs into technological or operational difficulties.

The B-1B program, he said, is "quite a few months ahead of schedule," with rollout of the first production aircraft now expected as early as September of this year. The prospects are that the B-1B program will not only come in ahead of schedule but under budget, meaning below $20.5 billion in FY '81 or $28.3 billion in "then-year" dollars, he explained. On the other hand, he warned, if the program is stretched out by cutting the monthly production rate from four to three aircraft—as recommended by some members of Congress—costs would go up by as much as $4 billion and the entire multiyear procurement structure would be voided.

### US Space Launch Strategy

Both the Space Shuttle and expendable launch vehicles (ELVs) are needed for the foreseeable future from the point of view of national security, the Under Secretary of the Air Force, Edward C. Aldridge, Jr., told Congress recently. Stressing that there is a "validated requirement" for an assured launch capability under peace, crisis, and conflict conditions, Secretary Aldridge explained this meant "complementary launch systems to hedge against unforeseen technical and operational problems and the need for a launch system suited for operations in crisis and conflict situations."

He conceded that while this assured access across the spectrum of conflict is essential from the Pentagon's point of view, "the ability to satisfy this requirement is currently unachievable if the US mainland is subjected to direct attack." The Defense Department, therefore, is pursuing technologies to "ensure sustained operations of critical space assets after homeland attack," he told Congress. Secretary Aldridge added that while the Pentagon supports the Shuttle and will rely on its four Orbiters for "primary access to space for all national security systems," sole reliance on this peacetime system would entail "an unacceptable national security risk." The limited number of Orbiters makes them "ill-suited and inappropriate for use in a high-risk environment," Secretary Aldridge stressed.

The solution to the problem, he suggested, must be an affordable and effective approach that entails neither undue technical risks nor lengthy development periods—in short, unmanned, expendable launch vehicles. ELVs complement the Space Shuttle by providing an assured launch capability under all conditions except general nuclear war. Since they are expendable, the loss of a single vehicle jeopardizes only one mission rather than truncating permanently the national launch capability—as would the loss of one of the four reusable Orbiters—Secretary Aldridge asserted.

He was guarded in regard to the potential need for a fifth Orbiter, saying that the current four-Orbiter fleet would support seventeen to twenty-five flights a year if all four vehicles were in service. Such a level of Shuttle launches would meet NASA's and the Defense Department's requirements, but there is concern about how long the fleet of four Orbiters can sustain a heavy flight schedule, given that "everything has a finite lifetime."

Because the Defense Department has "bumping rights" for national security priority use of the system, the Pentagon has never explicitly supported the acquisition of a fifth Orbiter. The need for a fifth Orbiter hinges on the question of how to maintain the long-term utility of the Shuttle program for the civil, commercial, and foreign users who make up about two-thirds of the available payload, he suggested. The answer to that question may be some time in coming because "our experience of the past year indicates that, while the Shuttle is a momentous achievement, it is still a most complex system and will require many more flights to gain insights into actual component performance and life expectancy."

Cautioning that space systems don't always work perfectly, that launch schedules change, that unpredictable failures of spacecraft on orbit necessitate quick replacements, and that the Defense Department's dependence on space systems is accelerating and increasing, Secretary Aldridge stressed that "not all Orbiters will be able to launch certain future Defense payloads."

Also, the "flexibility to integrate payloads into the Orbiter is not as we anticipated . . . and 'operational' launch rates have not yet been demonstrated." Lastly, the Pentagon requires "insurance" against possible Shuttle failures, fleet outages, and system vulnerabilities. This fundamental concern would exist, he stressed, regardless of the size of the Orbiter fleet.

The Defense Department, Secretary Aldridge noted, is concerned because "over the years we have observed a significant rise in the fraction of the [Shuttle] cost that is devoted solely to launching our spacecraft.

This increase, unfortunately, has been at the expense of our mission payloads."

As a result of these factors, the Defense Department is now investigating the use of a small number of complementary ELVs: "We would continue to plan eight to ten missions a year on the Shuttle but could complement this with two ELV flights per year. Some ninety percent of NASA's mission model would remain the same." He added that a key advantage of this approach is that "ELVs would give us additional flexibility and extend the life of the current four-Orbiter fleet while we are considering follow-on national launch capabilities."

The West Coast Space Shuttle launch facility at Vandenberg AFB, Calif., Secretary Aldridge reported to Congress, is now ninety-five percent complete. The first Shuttle launch from Vandenberg is scheduled for October 1985, and the full operating level of four launches a year is to be reached in 1987.

### Findings Encouraging on Superhard Silos

The Air Force and the Defense Nuclear Agency (DNA) are piling up evidence that ground bursts of nuclear weapons dig up craters of significantly smaller diameters than previously assumed and that these craters tend to take the shape of a cup rather than that of a saucer. Ancillary findings suggest that dry, loose soil tends to shrink crater size while wet, dense soil tends to enlarge it. This new evidence is of considerable practical importance because it strengthens the case of the Air Force/DNA superhard-silo program that was spawned in turn by the discovery that new Soviet ICBM silos were far harder than originally assumed by US intelligence.

Superhard silo structures have already been shown to be about twenty-five times harder to nuclear airblasts than the best Minuteman silos. While precise data are classified, the evidence accumulated recently by the Air Force and DNA indicates that superhard silos would be outside the crater area, resist even extremely high overpressures, and thus survive a near-miss.

Last May, "minijade," a small nuclear device, was tested in an underground cavern at the Nevada Test Site. While the cavern has not yet been reentered, camera probes have photographed a crater that appears to corroborate other recent findings concerning smaller-than-expected crater diameters.

Another series of tests meant to probe crater characteristics, known as the Cratering and Related Effects Simulation (CARES) program, also supports the new estimates. The so-called near-source simulation test (NSS) of last December, a part of the CARES research, yielded craters that were virtually identical to these findings.

The Air Force, meanwhile, has awarded a series of contracts for the design of a Hard Mobile Launcher for the new small ICBM (SICBM). The four contractors—Boeing, General Dynamics, Martin Marietta, and Bell/Textron—will work on concept definition for a vehicle to protect, transport, and launch the SICBM. These preliminary designs will include on-road as well as some off-road capability and center on deployment of the weapon on government installations.

Other SICBM contracts—some already awarded and others pending—involve booster definition as well as work on guidance and penetration aids. A key feature of the preliminary SICBM contracts is that they involve a parallel definition approach in order to reduce the time required for concept definition, encourage innovation, and drive down systems cost. The Air Force has cautioned all SICBM contractors that when full-scale development and procurement source selections are made in the latter part of this decade, "the costs must be reasonable and affordable."

### Washington Observations

★ The Soviet Union is lowering a new electronic curtain to blind this country's national technical means for verifying Soviet compliance with strategic arms-control accords. In addition to encrypting essential missile flight telemetry data in violation of the SALT accord, the Soviets have started to jam three of the most important sensors available to the US to gauge Soviet compliance with SALT II terms governing ballistic missile performance: Cobra Dane, Cobra Ball, and Cobra Judy.

Cobra Dane is a phased-array radar located on Alaska's Shemya Island that monitors Soviet missile tests. Cobra Judy is a shipborne phased-array radar aboard the USNS *Observation Island* that provides essential information about Soviet ballistic missile development programs as well as threat analyses for US ballistic missile defense programs. Cobra Ball is a specially configured KC-135 that usually operates out of Shemya to perform missions complementary to the other two Cobra systems.

The Soviets seemingly believe that these three sensor systems provide the same kind of information that they are trying to deny the US by encryption of their missile test-flight data.

★ Secretary of the Navy John Lehman recently told this writer that a unified command, such as the proposed unified space command, "does not lend itself to resource management." Stressing that the current arrangement, with the Under Secretary of the Air Force acting as the chairman of all defense-related space efforts, is working "extremely well" and is a "remarkably efficient apparatus" for coordinating and "harmonizing" the space efforts of the various agencies of government concerned with national security, he said that "I have yet to see one example of duplication since this system has been set up." He added that "if things are working, why do we need something else? . . . I don't follow that logic." Unified commands, he stressed, are suitable for joint military operations, but don't lend themselves to development and resource management. Further, under such circumstances they contribute to "dilution of civilian control."

Concerning Soviet activities that have become discernible since the recent break in arms-control talks between the two superpowers, Secretary Lehman told AIR FORCE Magazine that Moscow has turned over a third Foxtrot diesel-powered—and hence very quiet—submarine to Cuba. A diesel/electric-powered sub "in a chokepoint is a very difficult problem [and] worrisome." With three of these submarines in Cuba, US sea-lanes out of the Gulf of Mexico are seriously threatened, he said.

Furthermore, the Cubans are about to receive another Soviet frigate as part of an extensive naval modernization program. There has also been a "very substantial surge in Soviet Delta missile subs into the Atlantic." He termed this increase in Delta subs "a direct response" to the US deployment of Pershing II and ground-launched cruise missiles in Europe. These submarines are not, however, as effective in the Atlantic as in their normal deployment areas because the guidance systems of their missiles are optimized for longer flight times, he said. ■

# WORK SMARTER–NOT HARDER

## WITH THE SMART-CARD™ MANAGEMENT SYSTEM™*

## FROM EXEC-U-PLAN™

### DELUXE

Our most popular model

- Manages 288 projects: 2 panels—72 *SMART-CARDS* per side. Expands to 1440 w/purchase of extra panels
- 750 asst'd *SMART-CARDS*
- Color-coded signals
- Name or initials on cover
- Pen, tablet and business card storage
- Deluxe lock

Plus the *SMART-CARD Management System* Manual

Leather grained vinyl **$44.50**
Genuine leather **$84.50**
Plus $4 shipping and handling

### THE TRAVELER

Our streamlined model

- Manages 144 projects
- 500 asst'd *SMART-CARDS*
- Color-coded signals
- Name or initials on cover
- Pen holder

Plus the *SMART-CARD Management System* Manual

Leather grained vinyl **$27.50**
Genuine leather **$52.50**
Plus $4 shipping and handling

### SUPER DELUXE

Our premier model

- Manages 576 projects: 4 panels—72 *SMART-CARDS* per side. Expands to 1440 w/purchase of extra panels
- 4 tabbed dual pocket dividers
- 1,000 asst'd *SMART-CARDS*
- Multi-function calculator
- Digital time piece and alarm
- Calendar-phone-address book
- Color-coded signals
- Name or initials on cover
- Pen, tablet and business card storage
- Deluxe lock

Plus the *SMART-CARD Management System Manual*

Leather grained vinyl **$105.00**
Genuine leather **$155.00**
Plus $4 shipping and handling

**All Models Available in:**

**LEATHER GRAINED VINYL**
Chestnut Brown (dark), Willow Brown (medium), Black, Burgundy and Natural Tan Suede.

**GENUINE LEATHER**
Black, British Tan and Burgundy.

### GET MORE DONE IN LESS TIME

Control 20-50—even hundreds of projects at a time with the smartest, easiest, most flexible method ever developed for planning and monitoring activities, schedules, appointments, performance, details and deadlines. The SMART-CARD Management System helps busy executives accomplish more in less time—by freeing the mind's memory banks and thought processes to focus where it counts! No matter how well organized you are, The SMART-CARD Management System will give you a better return on your time investment. **We guarantee it!**

### CONTROL HUNDREDS OF PROJECTS WITH COMPUTER-LIKE EFFICIENCY

The SMART-CARD Management System is designed to function in many ways like a personal data processing center, but, with much greater flexibility and ease. Simply record all important information directly onto color-coded SMART-CARDS. Then insert them in the system's exclusive see-through panels—for visual control of hundreds of entries at-a-glance. Merge cards into the system after meetings. Move cards as projects are completed or priorities change. Retrieve information instantly. The SMART-CARD Management System's unique features and six special purpose cards help you plan and manage more effectively than ever before.

### QUALITY CRAFTSMANSHIP

Individually crafted of the finest genuine leathers or rich leather grained vinyls, each SMART-CARD System comes personalized with your name or initials on the cover. Take the handsomely styled, highly portable EXEC-U-PLAN System with you to meetings, on business trips, or for a more productive daily commute.

### WORKS FOR EVERYONE

Available in three styles to satisfy a wide range of needs and preferences, The EXEC-U-PLAN SMART-CARD Management System is ideal for all executives and professionals. With the system you're always so well organized, the time you save won't just be your own—it will increase the productivity of everyone around you. So, to Work Smarter-Not Harder, put the remarkable new EXEC-U-PLAN SMART-CARD Management System to work for you, and those around you, today!

***PATENT PENDING**

### SPECIAL BONUS

Now—for a limited time only—receive a handsome, matching Pocket Organizer **FREE** with any model shown at left. This compact tuck-away version of the *SMART-CARD Management System* puts key data in your pocket—and lets you easily make new entries on-the-go. Retail value $15.00.

**SATISFACTION GUARANTEED**
If for any reason you are not completely satisfied with your *EXEC-U-PLAN SMART-CARD System*, simply return it within 30 days of purchase for a *full and prompt* refund.

**CREDIT CARD ORDERS PHONE TOLL FREE**

**1-800-USA-0700**

OR WRITE: **EXEC-U-PLAN™** DEPT. 164

31-17 QUEENS BLVD., LONG ISLAND CITY, N.Y. 11101

Add $7.50 per model for shipments to Canada, Alaska, Hawaii and Puerto Rico, $12 to Mexico and $18 to all other countries.

An innovative engineering tool for producing the AMRAAM missile is expected to save the U.S. government and Hughes Aircraft Company millions of dollars and months of work. A full-scale prototype of the Advanced Medium-Range Air-to-Air Missile has been completed using actual engineering drawings, materials, and processes. The purpose of this "precision physical model" is to refine AMRAAM's design and detect potential manufacturing problems, especially those stemming from late improvements. Among other things, the model has been used to determine routes and lengths for wire harnesses so that mating connectors will line up. It also was used in designing handling and test fixtures, as well as to show how its components react to vibration. AMRAAM is in full-scale development at Hughes for the U.S. Air Force and Navy.

An advanced factory management system model, developed by Hughes and Computer Aided Manufacturing-International, will help optimize use of manufacturing resources. The model will address interactions of all work areas within the organization. It will precisely identify department production capacities, queue bottlenecks, and resource flow. Managers now must make decisions without knowing all interactions among workstations, cells, and departments.

The new M2/M3 Bradley Fighting Vehicle System has been fielded with U.S. Army units. The TOW weapon subsystem being produced for the vehicles includes a gunner's sight that sees targets shrouded in darkness, smoke, or haze. The unit, an integrated day/night sight, directs wire-guided TOW missiles, cannon fire, and machine-gun fire with pinpoint accuracy. Hughes is delivering TOW subsystems at a high rate of more than 50 per month. FMC Corporation is prime contractor for the M2 infantry and M3 cavalry vehicles.

Locations of enemy weapons can be pinpointed in seconds by the Firefinder radar systems. The AN/TPQ-36 and AN/TPQ-37 radars can locate artillery, rockets, and mortars often before the shells they have fired have exploded. The TPQ-36 radar is normally placed close to the front lines to locate forward artillery and mortars. The more powerful TPQ-37 can locate long-range artillery and rockets at their normal firing ranges. Firefinder's speed and accuracy allow friendly weapons to respond quickly enough to limit follow-on firing. Hughes manufactures the Firefinder systems for the U.S. Army, U.S. Marine Corps, and allied nations.

A network of small "smart" radios will let U.S. troops and their commanders know where they and friendly forces are located at all times. With the Position Location Reporting System (PLRS), combat troops will no longer have to seek landmarks to pinpoint their location. PLRS automatically supplies position and navigation data in digital form through a computerized communications network that displays data on a small hand-held box. PLRS units can be mounted on vehicles, aircraft, and helicopters. All units serve as automatic relay stations, so that units far away from a master station can stay in touch regardless of terrain or weather. Hughes is producing PLRS for the U.S. Army and Marine Corps.

# CAPITOL HILL

**By Kathleen G. McAuliffe, AFA DIRECTOR OF LEGISLATIVE RESEARCH**

Washington, D. C., Feb. 24

## FY '85 Defense Budget

The Administration's FY '85 defense budget of $313 billion, $305 billion for DoD, was declared dead on arrival in Congress. The thirteen percent growth is deemed unacceptable to members of Congress across the political spectrum in this high-deficit election year.

The budget total, which does not include an additional $2.3 billion requested in FY '84 supplemental funds to cover pay raises and military operations in Grenada and Lebanon, makes up in part for last year's congressional cuts. Reductions of $17 billion were made by DoD before submitting the spending blueprint to Capitol Hill. Any further cuts, expected to be $16 billion to $20 billion, will be at the expense of US national security, Defense Secretary Caspar Weinberger told Congress. The White House, however, notified congressional representatives of the *ad hoc* group seeking $100 billion in deficit reductions over three years that it would consider defense cuts as part of a total package.

House Budget Committee Chairman Rep. James Jones (D-Okla.) told Secretary Weinberger that a majority of Democrats and Republicans dismissed the FY '85 request as excessive in light of domestic needs, the deficit, and the US commitment not to fuel an "arms race." Current betting is that defense will be lucky to get five percent real growth, or $297 billion.

Some conservative House members are exploring a four percent increase. Five percent growth would follow last year's budget resolution, which set that level as the increase for FY '84 and '85. But Congress did not adhere to it in FY '84, appropriating only a 3.7 percent increase in funds for DoD. A similar outcome could befall the Pentagon this year, impeding Administration plans to slow defense growth to less than four percent beginning in FY '87.

Secretary Weinberger is steadfastly refusing, at least for now, to guide lawmakers in cutting defense spending. Having authorized numerous major systems in recent years, Congress has less flexibility to make cuts. Majority Leader Rep. Jim Wright (D-Tex.) thinks a stretch-out of procurement and force strength plans from five to six years could contribute significantly to deficit reduction. Such a plan could save up to $173 billion over five years, he claimed. According to Secretary Weinberger, stretching out buys of systems—a popular congressional tactic—raises overall cost per unit, especially when stops and starts of major systems occur.

## ASAT Limits

The Air Force expects one more test shot of its antisatellite (ASAT) system before reaching congressional limits imposed last year on ASAT testing. Those limits prohibit testing against a target in space unless the President certifies to Congress that a mutual ban on ASATs is being negotiated with the Soviets or that national security requires it. Air Force Secretary Verne Orr told a Senate panel that a second test firing from an F-15, expected before the summer, would probably be the last one before moving to testing ASAT against targets in space.

The Soviets now have limited ASAT capability in low orbits, but it is substantially improved since the late 1970s, USAF Chief of Staff Gen. Charles Gabriel said. US ASAT technology is superior but untested. Getting a verifiable agreement on ASAT testing as dictated by the legislation would be difficult with current technology, according to the Air Force Chief.

## C-17 Funding

The Air Force plans to begin full-scale engineering development of the C-17 inter/intratheater outsize cargo airlifter in FY '85 and has requested more money than originally planned. Last year, $32.6 million was projected for C-17 R&D in FY '85, but the budget proposes $129 million. The decision to begin full-scale engineering development blends well with overall airlift plans to buy fifty C-5Bs and forty-four KC-10s first. Previous C-17 funding—$60 million in FY '83 and $26 million in FY '84—was adequate to maintain a low but steady R&D effort, including wind-tunnel testing and mockup work.

Full-scale development in FY '85 will mean a production start in FY '88. Initial Operational Capability is expected in 1992.

Last year, the Air Force told Congress that the total estimate for development and acquisition is some $34 billion. Air Force plans to buy 210 aircraft will bring airlift capability to the congressionally mandated level of 66,000,000 ton-miles per day. Delivery will begin after final delivery of the C-5B.

## CBO Budget Analysis

The Congressional Budget Office (CBO) reported that $23.6 billion in FY '85 would have to be cut to limit defense spending to five percent real growth. Reductions of $29 billion would be required for a three percent increase; $37.4 billion in cuts would be required to freeze defense spending at the FY '84 level.

CBO offered numerous options to reach lower spending levels, including some key Air Force programs. It estimated that stretching out by two years USAF plans to expand to forty tactical fighter wings could save $2.1 billion over five years. Meanwhile, Soviet tactical fighter investment produces 1,300 aircraft per year.

Freezing production of the F-15 at thirty-six annually could save $8.7 billion. This would foreclose attainment of a forty-wing equivalent by 1989 unless older F-4s are kept in the inventory past the usual twenty-year service life.

Cancellation of the USAF night precision-attack program, LANTIRN, could yield a five-year savings of $2.8 billion. This ignores the need for such infrared targeting and navigation pods. The Air Force told a Senate panel that it has studied other Forward-Looking Infrared Radar systems, but finds them unsuitable for USAF aircraft and unable to provide the same capability as LANTIRN without a substantial increase in cost. ■


# If you have a bigger job,

It's the C-130H-30 Super Hercules. We've expanded its fuselage and cargo compartment, making it 15 feet (4.57 meters) longer than the standard C-130 Hercules.

That gives you nearly 40% more room for cargo and personnel. It's big enough, too, to carry complete helicopters and aircraft engines as well as pallets and containers.


# we have a bigger Hercules.

And it can airlift 36 more combat-equipped troops than the standard C-130H—a total of 128.

Five nations already have chosen the Lockheed C-130H-30 Super Hercules. If you have bigger jobs to do, you should, too.

**Lockheed Hercules**

# VIEWPOINT

# Questioning the Superstructure

By Gen. T. R. Milton, USAF (Ret.), CONTRIBUTING EDITOR

*How do you make the Pentagon machinery more efficient without making things worse?*

During World War II, a lot of us used to wonder, innocents that we were, what would become of the Pentagon when the war was over. Clearly, it was too large for any conceivable defense use in peacetime. Maybe, we guessed, it would serve as a giant veterans hospital when the War and Navy Departments moved into cozier and more suitable quarters.

Well, as I said, some of us were innocent. While the Pentagon may have served nicely as headquarters for the vast events of World War II, it has long since become too small for the present overseers of national defense. The Pentagon has become the cathedral, so to speak. There are chapels all over town.

The genesis of the colossus called the Department of Defense was the National Defense Act of 1947, and it, too, was conceived in all innocence. Lt. Gen. Victor H. Krulak, a retired Marine with impressive credentials, has produced a thoroughly readable account of the events surrounding the birth and subsequent development of what we now call OSD. *(See* Organization for National Security, A Study, *United States Strategic Institute, Washington, D. C.)*

Those present at the creation were unaware, like Dr. Frankenstein, of what they had wrought. The original concept was both lofty and modest, envisioning a Secretary of Defense with considerable authority but little in the way of staff: "Fifteen to twenty-five $10,000-a-year men, in order to make certain that he could not undertake any detailed administration." James Forrestal, who was to be the first Secretary of Defense, aimed a little higher: "Not over 100 people."

Again relying on General Krulak, the actual strength of OSD in January 1982 included a Deputy Secretary, two Under Secretaries, seven Deputy Under Secretaries, seven Assistant Secretaries, twenty-seven Deputy Assistant Secretaries, eight Special Assistants, 121 Directors, and 87,700 other people.

Despite occasional attempts to halt the growth of this apparatus, the process has thus far been irreversible. And though political appointees come and go at regular, usually short, intervals, the civil servants entrenched in OSD remain and gain authority with the passing of time. They represent corporate knowledge, and thus continuity.

Now, in the wake of recent events, people are once more questioning the defense superstructure. The Joint Chiefs of Staff are coming in for particular scrutiny. Not surprisingly, the retired Marine's study concludes that the present system would be good enough with the elimination of the Chairman, which is a position General Krulak finds superfluous. Others argue for a strengthened Chairman, one who would be the link to the unified and specified commands and who would have real authority over the services.

There is no pat answer. The case can be argued either way. A Chairman endowed with considerable authority might, if he were the right fellow in the right administration, be of great use. Conversely, it is easy to imagine a powerful Chairman of the Joint Chiefs of Staff as a source of great mischief. It all depends, and the organizational arrangement is no guarantee of anything.

Centralization of authority has had immense appeal in the years since World War II. One reason is the speed of communication. When the Commander in Chief or his surrogate, the Secretary of Defense, can talk directly to the destroyer skipper or even to the pilot in the cockpit, why fool around with intermediate headquarters? The Vietnam era saw a lot of that sort of thing. When the phone rang, it might be the Man himself.

Lord Nelson put his blind right eye to the telescope and was thus unable to see Signal 39, the order to withdraw at the Battle of Copenhagen. Happily for him and for Britain, there were no instant circuits to London, or there might not now be a Nelson monument in Trafalgar Square. Or, for that matter, a Trafalgar Square. The British Empire was founded and sustained on a broad delegation of authority to generals and admirals who, in turn, delegated to subordinates.

Undoubtedly, there is much wrong with the arrangements in the Pentagon, although there is considerably less wrong at the moment than in recent times past. Equally without doubt, the Joint Chiefs leave a lot to be desired in the way of arriving at decisions efficiently. The question remains as to how you make the machinery more efficient without, in the end, making things worse.

The problems that have plagued our use of military power in recent years are hard to nail down. Sometimes, as in Vietnam, they are to a large extent political. And sometimes, without being specific, they appear to be the result of too much high-level supervision.

Beginning in the 1960s, the armed forces have been subject to sociological experiments, Great Society military justice adjustments, and fluctuating budgets. Toward the end of that decade, they hit bottom. From that nadir, the military has more than recovered. By all accounts, the quality of people now joining up is the highest ever. Admittedly, there is still room for improvement in the little niceties that distinguish the military profession from a job at General Motors—the wearing of the uniform, military courtesy, and the truck-stop atmosphere at some Officers' Clubs come to mind—but mostly, things are looking up.

Perhaps, then, the best way to improve the Joint Chiefs and the Pentagon is to make better use of the talent lower down. Squadrons off by themselves have a way of doing better than the ones blessed with layers of supervision. ■

# The largest airline in the free world is ready to take on a new challenge.

# Introducing United Airl
# Ready for the

United Airlines is prepared to put its heavy jet experience to work for the military.

Introducing United Airlines Aircrew Training, Inc.—a separate, specialized strike force of United Airlines' finest aircrew training knowledge. Aircrew Training spearheads a team of military and commercial professionals, offering a broad base of expertise, but with single source project responsibility and accountability.

The Aircrew Training team is built on experience. CAE Electronics, known throughout the world for the quality of its flight simulators, was the first to build the highly sophisticated Phase III simulator, and has many years' working experience with United. Seville Training Systems is an established leader in total training system analysis and design.

Aircrew Training also draws on United Airlines' many years of widebody training experience. United flies the largest widebody fleet in the world. Its total commitment to Cockpit Resource Management and Line Oriented Flight Training, uniquely combined in United's current aircrew training program, is critical to the quality of aircrew performance. And the people who made it happen at United will make it happen in the C5 aircrew training system . . . and beyond.

# es Aircrew Training, Inc.
# . And beyond.

United has a long historic relationship with MAC, dating back to the Alaskan and Pacific Operations of World War II. United understands the difference between military and commercial operations, and will involve MAC in all phases of the training system. United knows that the quality of aircrew performance rides directly on the quality of training.

Combined—CAE, Seville, and United Airlines—the Aircrew Training team represents a new force in aircrew training. A new force which is ready to work on the C5 aircrew training system... and beyond.

**UNITED AIRLINES AIRCREW TRAINING, INC.**

**The new force in aircrew training.**

cae Electronics, Ltd.

Seville Training Systems

UNITED AIRLINES

# Meet the new force in aircrew training.

## UNITED AIRLINES

• The largest airline in the Free World, flying more people than any other—with 322 jets—over 1 million miles every day. • A long productive relationship with the U.S. Air Force through the CRAF Program. • Understands exactly how aircrew training fits into the big picture of operating an airlift system. • A successful survivor of airline deregulation, and will be around to back up its commitments for the life of the C5... and beyond.

## UNITED AIRLINES AIRCREW TRAINING, INC.

• Wholly owned subsidiary of United Airlines, created specifically to develop, implement and manage state-of-the-art aircrew training systems under contract. • C5 expertise is resident in the staff, a staff who, from the top down, have been responsible for the success of aircrew training at United Airlines and for the U.S. Air Force. • Will have access to the total resources of United Airlines and the United Airlines Training Center to help accomplish any aircrew training system under contract.

## CAE

• 30 years experience building military and commercial simulators. • Integrated engineering and manufacturing facility with 1500 employees, over 600 engineers, scientists and technicians. • 72 commercial simulators built for 32 customers in 21 countries. • 90 military simulators supplied to 16 countries for tactical, helicopter and transport aircraft, including recent deliveries of C-130, P-3C, E-3A, CP-140, CF-18 and Tornado. • A five-year working relationship with United Airlines which includes the supply of five Phase II and III simulators.

## Seville Training Systems

• Successful track record of analyzing, designing and developing aircrew training within the Instruction Systems Development (ISD) framework. • Experience and production capacity appropriate for large aviation ISD projects. • Long association with United Airlines and the U.S. military.

## UNITED AIRLINES TRAINING CENTER

• United's training and maintenance operations are the largest. Trained pilots for most of the world's major airlines and a leader in safety and flight innovations. • Proven over and over again that it can field effective aircrew training systems in a timely and low-risk manner. • Has aircrew training, human resources and material in quantity and in depth. Any show-stoppers possible in a system contracted to Aircrew Training? Highly unlikely with this experience resource base backing them up.

# AEROSPACE WORLD
## News, Views & Comments

Washington, D. C., March 5

★ Minute measurements may lead to substantial dividends, NASA research indicates. For example, barely visible grooves on the surface of an aircraft may help tame drag-producing air turbulence and increase fuel efficiency.

The grooves, each shaped like a tiny "V" with the angle pointing forward on the fuselage, might be no more than two-thousandths of an inch deep. But they would be deep enough, NASA thinks, to favorably alter the turbulent flow of air that forms over the surface of a moving airplane.

And on today's aircraft surfaces, most of the airflow is turbulent. Within this flow are violent eruptions called bursts that begin at the surface and are responsible for most of what aerodynamicists call "skin friction drag." That constitutes almost half the total aerodynamic drag on an airplane. Conversely, if the intensity of these bursts can be reduced, the reduction in drag would translate directly into lower fuel consumption or increased aircraft speed.

Reducing skin friction drag has been targeted by NASA's Langley Research Center, Hampton, Va., as a research goal of the 1980s, with a major focus on understanding and controlling turbulent bursts.

Experiments at Langley have shown that small "V" grooves of equivalent height and spacing can reduce net turbulent skin friction drag up to ten percent as compared to ungrooved smooth surfaces. The grooves, also called "riblets," were machined into flat aluminum samples that were tested in wind tunnels.

The payoff: A ten percent reduction in turbulent drag would yield a two and a half percent decrease in fuel consumption. Potential annual savings for the nation's commercial airline fleet could total $200–$300 million, estimates Jerry N. Hefner, a researcher at Langley's High-Speed Aerodynamics Division. The division's long-range goal, he says, is to double the demonstrated drag reduction to twenty percent and thereby reduce fuel consumption by five percent.

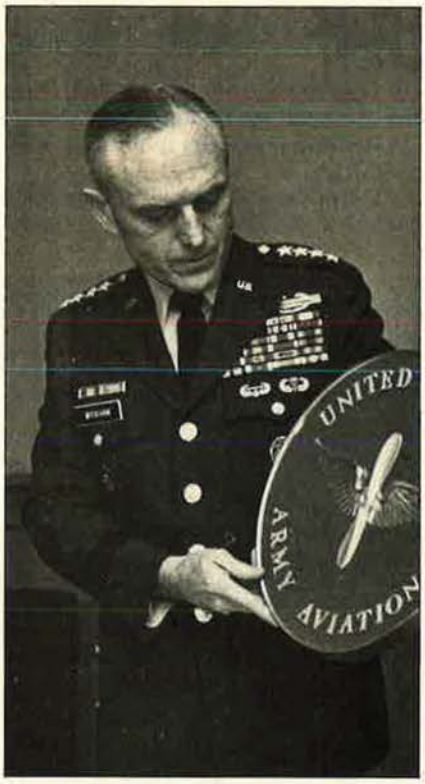
NASA is increasingly confident that these relatively small-scale results can be repeated on a full-sized transport aircraft under flight conditions. If the concept continues to prove itself in ground tests, the first flight test could come within eighteen to twenty-four months, NASA said.

An interesting sidelight is that recent observations indicate that projections—called dermal denticles—on the skin of fast-swimming sharks resemble riblets. NASA researchers, however, insist that they identified the riblet concept and its precise "V" shape before this clue from nature was discovered.

★ An English professor and an Air Force Academy senior engineering class have teamed up to give certain handicapped people a chance to fly.

Terry Frazier, an associate professor at the University of North Carolina at Charlotte, lost both legs as a paratrooper in Southeast Asia. Recently, he climbed into the cockpit of a specially modified sailplane and spent a thrilling fifteen minutes soaring over the Academy campus.

Using a device specially designed and built by cadets, the handicapped pilot guided the sailplane with ease. The device enables handicapped people to operate the aircraft using only their hands. "Rudder controls must normally be operated with the feet, prohibiting many handicapped people from experiencing the thrill of flying," Mr. Frazier said. "This design works better than I had hoped. It will




***Army Chief of Staff Gen. John A. Wickham, Jr., displays the plaque signifying that aviation has become the Army's newest basic career branch. See earlier related item, "Aerospace World," June '83, p. 28.***

***New equipment designed by an Air Force Academy engineering class is allowing handicapped people like Terry Frazier, an associate professor of English at the University of North Carolina at Charlotte, to fly. See item.***

be easy for beginners to learn to fly with this. These cadets did something to be proud of."

Mr. Frazier came to the attention of Academy personnel at a national soaring convention in March 1983. He had taken up soaring in 1978 and had been competing since 1981. He normally uses a specially designed set of artificial legs to control the aircraft.

In league with Mr. Frazier, Maj. John Burkhart, Academy airmanship operations officer, and Capt. Rick Pillings came up with the idea of having cadets design the device. "It seemed a natural for an Engineering 430 class," the Major explained. The senior-level course is designed to integrate all engineering disciplines into a single class project.

"Handicapped people usually can't compete well with walkers in most sports, but soaring is a sport where we can compete head-to-head with anyone," Mr. Frazier said. "There is no such thing as a handicapped pilot—you either are a pilot or you're not. We can compete with anyone at this," he added.

"When I first wanted to fly, it was impossible for me," Mr. Frazier said. "There was no equipment available that would allow me to fly without legs. Now, through the efforts of these cadets, no one else will have to suffer through that. They have opened up a whole new world to people who already have too many doors closed to them."

★ United Technologies Corp.'s Sikorsky Aircraft has been given the green light for the design, development, and flight testing of the revolutionary X-Wing for NASA's Rotor System Research Aircraft (RSRA).

# AEROSPACE WORLD

The X-Wing program, jointly sponsored by the space agency and the Defense Advanced Research Projects Agency, is to demonstrate the feasibility of starting and stopping the X-Wing rotor in flight. This will allow conversion from low-speed rotary-wing flight to fixed-wing flight at speeds from 250 to 300 knots and back again to rotary-wing flight, officials explained.

Flight tests are expected to begin in early to mid-1985.

The X-Wing features the circulation-control principle, in which compressed air is blown through spanwise slots along either edge of the symmetrical airfoil. This generates lift.

The X-Wing rotor is to be constructed of composite materials and will be completely bearingless and hingeless. The compressed air to feed the circulation control slots is to flow through separate plenums in the leading and trailing edges.

The conversion from rotary-wing to fixed-wing flight and back again constitutes the major engineering challenge. "Stopping or starting the rotor is accomplished by a clutch between the turboshaft engines and the RSRA gearbox. During conversion to fixed-wing flight, the clutch is disengaged and the X-Wing is indexed to its correct azimuthal position and locked in place.

"The compressed air in the two wings on the left side of the aircraft is redirected from the slots on what was the trailing edge in rotary-wing flight—pointing forward—to the 'new' trailing edge in fixed-wing flight, now pointing aft," engineers for the Stratford, Conn., based company explained.

During conversion from fixed-wing to rotary-wing operation, the clutch is engaged, the wing unlocked, and the airflow redirected to the slots on the forward edges of the wings on the left side of the aircraft.

★ "The largest audit in the history of the Department of Defense is well under way to examine the procurement of spare parts," according to Secretary of Defense Caspar W. Weinberger.

Under the leadership of the Defense Inspector General, the action involves nearly 300 auditors from service audit agencies, the Defense Contract Audit Agency, and the IG staff. The auditors are reviewing prices charged by 200 major contractors who supply spare parts to DoD. Also included in the audit is an overall review of the spare-parts procurement process.

The prime objectives of the audit are to:

- Quantify the degree to which DoD has overpaid for spares.
- Identify practices that led to this condition.
- Determine if policy and procedure changes, beyond those already

## Sheppard Alcohol Rehab Program Is USAF's Most Progressive

"The Alcohol Rehabilitation Center reflects a significant shift in the way the Air Force regards alcohol abuse by its members," says Maj. Arthur P. Moser.

Major Moser is referring to a specialized Air Force health-care facility at the USAF Regional Hospital at Sheppard AFB in Texas. There, USAF's philosophy of humane treatment rather than more harsh remedies for alcohol offenders has been in full swing for about six years.

Major Moser carries the unusual Air Force Specialty Code of Social Worker and is currently the Center's Program Director.

With its staff of thirty-six health and other professionals and its forty beds dedicated to the program, the Sheppard Center is the largest such facility in the Air Force and has double the capacity of any of the other eleven centers devoted to the resident care of victims of the disease of alcohol abuse.

"All active-duty Air Force personnel are entitled to treatment and are accepted on a priority basis. The same is true of retired and dependent patients, but on space-available terms," Major Moser noted. "The program is twenty-eight days in length, including weekends. Detoxification—usually at a patient's base hospital—is mandatory prior to admission. Eight to ten patients begin the program each week," he added.

While restrictions on personal activities ease off after the first several weekends, treatment days during the week begin at six in the morning and continue to ten at night.

The other aspect of the program's treatment is the Center's strong ties with the local civilian community in the form of cooperation with the Wichita Falls chapter of Alcoholics Anonymous. Major Moser considers the link with the AA chapter essential to the success of Sheppard's rehabilitation program. "AA has a long record of success," he asserts. "It works."

"One night a week, the chapter meets at the hospital here at Sheppard to conduct its group-therapy program," explained Major Moser. "The other six evenings we send our recovering patients downtown to chapter meetings. Thus, they attend AA meetings every day of the week," he added.

How are blue-suit alcohol abusers identified? "While a number turn themselves in for treatment, supervisors usually tag the majority," explained Major Moser. They are prompted—with little fanfare and no notation on records—to visit the base's Social Action Office. There, committees composed of office representatives and personnel from the parent command and other support agencies evaluate individual cases and determine treatment.

made, are needed to achieve more economical acquisition of spares.

Secretary Weinberger pointed out that this major audit is only one part of a larger effort to improve the manner in which DoD buys spare parts. That effort includes the previously announced ten-point program to clean up pricing abuses in spare-parts procurement. The program includes incentives and rewards, appropriate disciplinary action, a tough stance toward contractors, use of competition advocates, and vigorous audits and investigations.

The Secretary indicated he expects to receive the audit report this spring and to take prompt action to correct any deficiencies identified by the auditors.

★ But all is not gloom, doom, and skyrocketing costs in the defense procurement business. At least not for Air Force Col. Joseph Rutter.

Colonel Rutter is the Air-Launched Cruise Missile program director in Aeronautical Systems Division's Deputate for Strategic Systems at Wright-Patterson AFB, Ohio. The ALCM program staff's recent success in reducing FY '83 procurement costs has enabled Congress to transfer $15 million of FY '83 funds to support FY '84 requirements.

Colonel Rutter attributes this accomplishment to a team effort by his staff, the prime contractor—Boeing Aerospace Co. of Kent, Wash.—and an Air Force "Should Cost" team consisting of people from ASD's Strategic Systems and Contracting and Manufacturing organizations, the Air Force Plant Representative Office at Boeing, and the Defense Contract Administration Services District Offices in Seattle, Wash., and Denver, Colo.

The "Should Cost" team initiated action in August 1982 by evaluating Boeing's cost proposals for the FY '83 procurement buy. Team members conducted an in-depth review of the company's manufacturing processes and procedures to arrive at an independent estimate of what the contract items "should cost."

Armed with this data and information compiled by Boeing in its own internally conducted cost-reduction program called "Curve Buster," the negotiation team arrived at a price that was more than $20 million below prior government estimates for this procurement.

Of the total savings achieved, more than $15 million was transferred by Congress to support FY '84 requirements while the balance was used to satisfy other high-priority ALCM modification program requirements.

## USAF Logs Best Flying Safety Record in Its History

The Air Force logged the best flying safety record in its history in 1983, marking the third consecutive year of significant improvement in the overall rate of mishaps.

The 1983 rate of 1.73 major mishaps per 100,000 flying hours beats last year's record of 2.33.

"One major contributing factor has been the performance of the three newest fighters, the F-15, F-16, and A-10, which have proven safer and more maintainable than any of their predecessors," said Air Force Chief of Staff Gen. Charles A. Gabriel.

"These high-technology aircraft have allowed the Air Force to improve the safety rate during a period when the Air Force has one of the youngest pilot and maintenance forces in recent history. This rate was achieved in a year when the crews flew in the most realistic and demanding training environment ever," General Gabriel added.

Approximately 3.4 million hours were flown in 1983, with fifty-eight aircraft destroyed. The Air Force had a major accident rate of 5.8 in 1960, with 426 aircraft destroyed or sustaining major damages; in 1950, the rate was 36.0, involving 1,744 aircraft damaged or destroyed.

Air Force safety officials cite the Military Airlift Command's accident rate as a contributing factor to the significant improvement made during 1983. Officials note that even though military flying cannot be equated with civil commercial aviation because of the differing environments, MAC's rate is better than that of many commercial, passenger-carrying aircraft. MAC's C-141 and C-135 aircraft posted a perfect record of no mishaps in 1983.

Other notable safety accomplishments for 1983:

- No Air Force helicopter losses.
- Air Training Command, Air Force Reserve, and Strategic Air Command rates of less than 1.0.
- A significantly lower number of maintenance-related accidents.

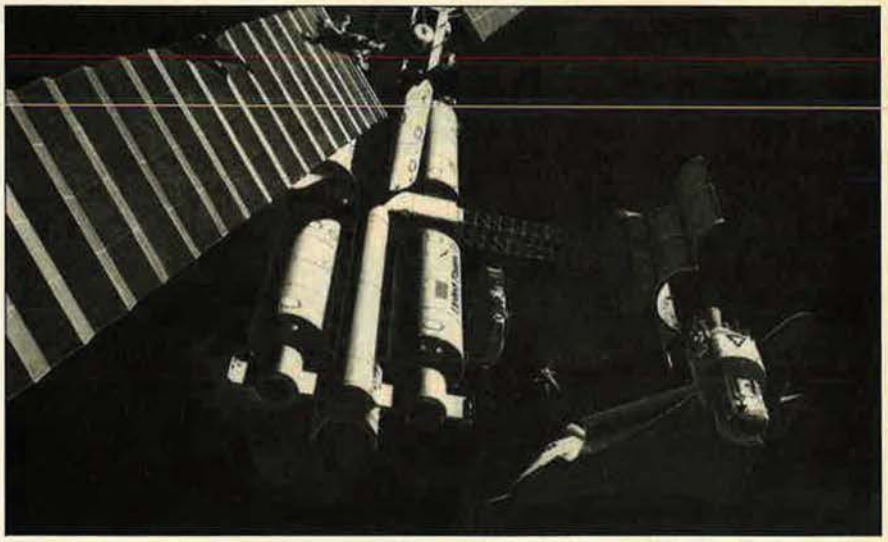
★ In a major streamlining move, the Army plans to increase the strategic flexibility of US ground forces by converting one of its infantry divisions to a "light division."

"Resources made available to the Army as a result of the conversion of the 7th Infantry Division, Fort Ord, Calif., and other adjustments throughout the Army will provide the basis for activation of initial elements of a new light infantry division," officials noted.

No decision has been made on a home base for the new division. Determining factors include availability of training areas and troop and housing facilities and—equally as important—the proximity of airfields for strategic deployment.

The Army indicated that it was also "looking at" other divisions, such as the 25th Division currently stationed in Hawaii, for similar tailoring.

"The light divisions will each have a strength of approximately 10,000 sol-



***Lockheed Missiles & Space Co. has conducted a study for NASA that one day could evolve into a space station such as this. In this artist's rendering, station control and operations are conducted from the central vertical module. With attached solar arrays, thermal radiators, and communications equipment, this central module would be the first section of the station placed in orbit.***

# Where Technological Innovation Becomes Reality

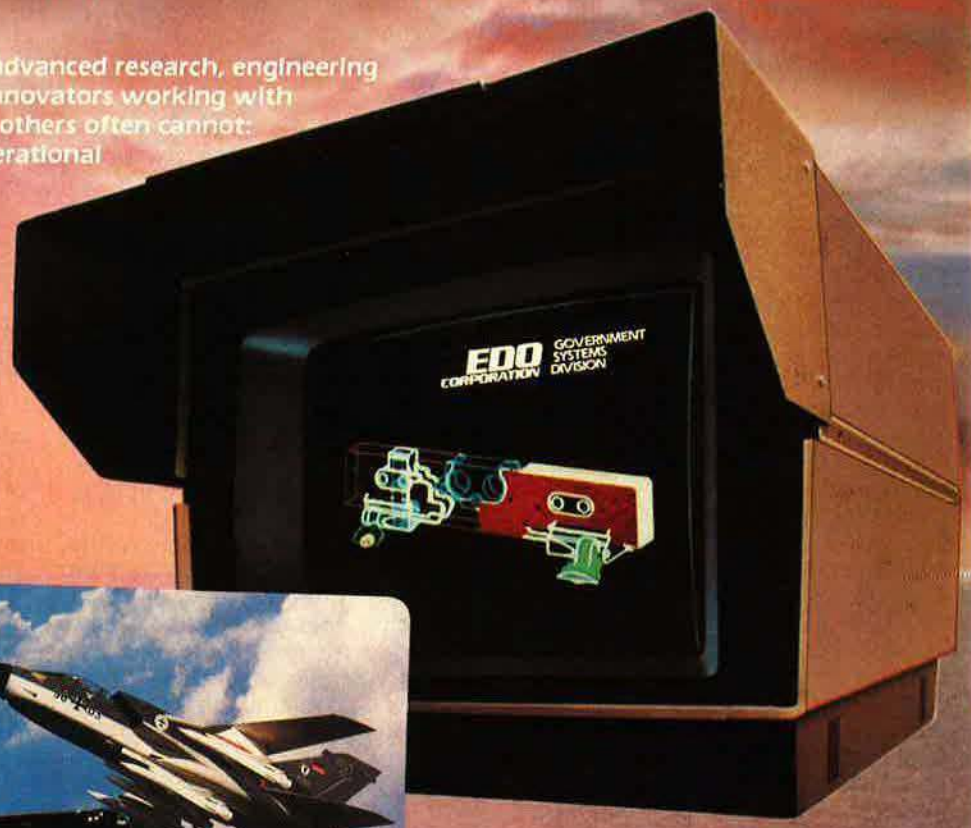
**From aerospace to hydrospace. From concept to operational readiness. Integrating advanced technologies with operational requirements. This is EDO, Government Systems Division meeting the Free World's defense needs with unsurpassed performance, reliability and responsiveness.**

- **ARMAMENT SYSTEMS**—Ejector release units, launchers, pylons, external stores and controls for high performance aircraft and helicopters.
- **ADVANCED ASW SONAR SYSTEMS**—Surface and submarine sonar systems, hull-mounted and variable depth towed systems, tactical towed array systems and depressor towed systems.
- **MINE COUNTERMEASURES SYSTEMS**—Airborne and surface-towed magnetic countermeasures and detection systems.
- **AEROSPACE / HYDROSPACE STRUCTURES**—Amphibious floats, aerospace structural subsystems and components. Surface and subsurface hydrodynamic bodies and structures.

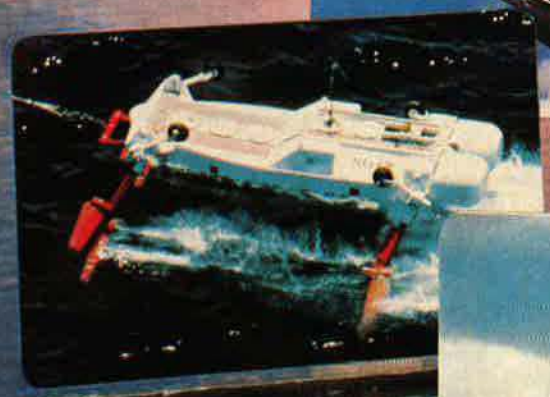
EDO is effective management, advanced research, engineering and production...experts and innovators working with our customers to achieve what others often cannot: outstanding performance in operational systems...Reality.

For more information, contact:

Marketing Department
EDO Corporation
Government Systems Division
College Point, New York 11356
USA
Telephone: 212 445-6000
Telex: 127421






**EDO CORPORATION** GOVERNMENT SYSTEMS DIVISION

Where Technological Innovation Becomes Reality

diers, compared to 14,000–17,000 in other Army divisions. About 5,000 members will be combat infantrymen," officials said. This smaller division will permit rapid deployment of Army forces to any location without sacrificing fighting strength, they added.

★ Airplanes capable of flying to any point on earth in less than two hours may be in use by the year 2000, according to McDonnell Douglas Corp. officials.

The craft are called TAVs, for transatmospheric vehicles. They are being studied for the Air Force by McDonnell Douglas.

"An F-15 Eagle fighter can fly from Maine to the Indian Ocean in seventeen hours," said Paul A. Czysz, TAV Program Manager. "A TAV could make the same trip in less than two hours."

McDonnell Douglas has been working on a TAV for several months, ever since the Air Force asked the company to start investigating a plane that could take off from earth, propel itself into suborbital flight, and then return to the atmosphere for conventional flight.

The requirements for such a vehicle, according to Mr. Czysz and Deputy Program Manager Art Robertson, center on three things: the aerodynamics of a slender cone, a propulsion system with the abilities of both an air-breathing jet engine and a rocket motor, and a fuel of liquid hydrogen and oxygen.

"The hydrogen and oxygen fuel is necessary for power to go in and out of the atmosphere," noted Mr. Czysz. "But it also means a relatively large vehicle because we need a large volume of fuel," he added.

"It may need to take off vertically," said Mr. Robertson, "and streak directly to 100,000 to 500,000 feet, orbit, and then descend into the atmosphere to fly more or less like a conventional plane, but at higher speeds."

The speeds involved are on the order of more than 3,000 miles per hour—more than four times the speed of sound.

Above 100,000 feet, the craft could move at sixteen to twenty times the speed of sound because of thin or no atmosphere, Mr. Robertson said.

The TAV would be piloted by a crew of one or two. The next step, according to the TAV program managers, will be to develop the technology needed to build a prototype TAV.

★ Shale-derived JP-4 jet fuel has been flight-tested in an F-16 Fighting Falcon at Edwards AFB, Calif., Air Force officials have announced.

Flight testing is one of the transition steps between research and operational validation of the fuel, which meets all of the current JP-4 specifications.

The F-16 testing required approximately fifteen flight hours to check the fuel's performance throughout the flight envelope. Additional test flights using an F-111 aircraft have been scheduled at McClellan AFB, Calif.

The aircraft flight tests follow extensive shale JP-4 ground testing using the F-16 engine (the Pratt & Whitney F100) and the F-111 engine (the P&W TF30). The F100 underwent the equivalent of 1,000 flight hours of running time, and the TF30 has been ground-tested an equivalent of 500

# AEROSPACE WORLD

## Tail Fins Are Making a Comeback

Yes, tail fins are making a comeback.

This time, however, the fins will not be flashy and they will not be a phenomenon of the automobile industry. Rather, they will grace the afterbody of one of the world's most popular transport aircraft—the C-130 Hercules.

The fins, known as "afterbody strakes," are being designed and developed as a result of an Air Force contract awarded to Lockheed-Georgia Co., Marietta, Ga.

The Air Force plans to retrofit its fleet of C-130B, E, and H aircraft with the strakes. Retrofitting will take place at Warner Robins Air Logistics Center, Robins AFB, Ga., and at other Air Force maintenance depots.

The lightweight fins will be installed under the horizontal stabilizer of the C-130s to smooth out the airflow in the airplane's wake. The strakes consist of two Kevlar fins measuring seven feet long, five inches thick, and twenty inches high. Attachment fittings are being incorporated underneath the plane's horizontal stabilizer during fabrication.

The Kevlar composite strakes will result in a 3.5 percent reduction in the aircraft's fuel consumption on long-range cruise, and an even greater savings on high-speed missions, according to Lockheed-Georgia officials.

Assuming a price of $1.17 per gallon of JP-4 fuel, the Air Force estimates savings for its 550 C-130s in excess of $3.5 million per year.

Another advantage of the strakes is that the C-130's speed can be boosted by eighteen knots—from the current cruise speed of 300 knots to 318 knots—with the use of no additional fuel over that burned on current C-130 models.

Furthermore, the strakes will smooth the airflow and prevent the buildup of vortices in the area underneath the plane's horizontal tail. The vortex buildup—swirling airflow—has been due to the C-130's flat, upswept afterbody that was designed to provide full-width aft cargo doors.

According to Lockheed engineers, once an airplane has been outfitted with the proper attachment points, strakes can be installed by ground crewmen in less than an hour. The interchangeable units are designed so that, even with high-standing cargo loads, the fins can be "opened out" to enable cargo to be loaded without interference and can then be reset to normal position for flight.

***A Lockheed-Georgia Co. employee attaches a prototype "afterbody strake" underneath the empennage of a C-130 aircraft. The Air Force plans to retrofit its fleet of C-130B, E, and H models with the strakes.***

flight hours with another 500 hours of tests in progress.

"What makes shale-derived fuel attractive is the abundance of rich deposits within the US. Estimates of recoverable quantities of oil range from 600 billion to several trillion barrels," according to Air Force Systems Command's Aeronautical Systems Division.

Upon completion of the testing, the Air Force plans to begin a two- to four-year operational validation phase. Shale JP-4 will be used exclusively at Mountain Home AFB, Idaho, and at Hill AFB, Utah, beginning in mid-1984.

★ The Stinger, a hand-carried weapon currently in production for the Army and the Marine Corps, has been selected by the Air Force as an air defense system for use as a ground-based point air defense weapon.

"The weapon is a shoulder-launched, fire-and-forget missile that is highly effective against high-speed maneuvering aircraft as well as slow or hovering helicopters. The portability and high reliability of the system greatly add to the operational utility of the Stinger," according to Air Force officials.

At a unit cost of about $70,000, including training and support equipment, the Stinger represents an extremely cost-efficient point air defense system, an Air Force spokesman said.

The maintenance-free design affords the Air Force a minimum ten-year storage life without degradation of performance and is ideal for deployment to air bases worldwide.

★ USAF's HH-60D Night Hawk combat search-and-rescue helicopter has made its first flight at United Technologies' Sikorsky Aircraft Development Flight Center at West Palm Beach, Fla.

# AEROSPACE WORLD

At the controls for the sixty-six-minute flight were Sikorsky Night Hawk project pilot Phil Pacini and Maj. Jerry Keyser, USAF, Chief Development Test Pilot for Helicopters at the Air Force Flight Test Center, Edwards AFB, Calif., and Director of the HH-60D Combined Test Force.

"I was very impressed. The flight was very smooth," Major Keyser said. "There is no real change in the flying qualities from the basic Black Hawk," he added, referring to the Army/Sikorsky UH-60A helicopter from which the Night Hawk is derived.

High points of the first flight included flying the aircraft to speeds in excess of 150 mph, autorotation, level turns, a pullout at 1.5 G, and a push-over at 0.5 G. Takeoff weight was 16,800 pounds.

The Night Hawk will undergo contractor shakedown tests until early May, at which time it will be taken to Edwards AFB for Air Force development flight tests.

The Air Force has a requirement for 155 HH-60Ds. The Night Hawk will be the first new Air Force combat rescue helicopter type since the Vietnam era. Deliveries of production aircraft are scheduled to begin in 1988. *(For more on the HH-60D, see February '84 issue, p. 102.)*

★ AFSC's Electronic Systems Division has transferred program management responsibility for the E-4B Airborne Command Post to Air Force Logistics Command's Oklahoma City Air Logistics Center.

The E-4B is a modified Boeing 747, with extensive command control and communications equipment. The aircraft can maintain communications even after a high-altitude nuclear burst has disrupted many commonly used radio systems. The four-aircraft fleet is home-based at Offutt AFB, Neb., but deploys to various Stateside bases in support of the National Command Authorities. The E-4B would be used as a command post in the event of nuclear war.

The program transfer marks the end of an era at ESD, one which began a decade ago with the initial design of the E-4A. The follow-on E-4B program cost $20 million less than the cost projected during the last three years. Savings were shared by the Air Force, the Boeing Aircraft Co., and E-Systems Corp. under a fixed-price, incentive fee contract.

Efforts in the new program office now focus on such programs as the Air Force Satellite Communications Monitoring Subsystem Computerized Depot Support Equipment, adaptive high-frequency systems, superhigh-frequency satellite terminals, and the Worldwide Airborne Command Post Replacement System.

★ In another ESD development, a new radar station that fills a gap in Spain's air defenses has been turned over to the Spanish Air Force by ESD.

Located on Barbanza Mountain in northeastern Spain, the station has two radars—one detects aircraft out to 200 miles and the other gives the altitude of aircraft. Both systems feed information to the Spanish Air Force's Combat Operations Center.

"Now that Barbanza is operating, the Spanish Air Force has standardized radar equipment at all its military air traffic control and warning centers," said Lt. Col. W. C. Zisch, USAF, Spanish Systems program manager.

"Credit for Barbanza's successful completion goes to various USAF and Spanish Air Force agencies involved in the project. Their close cooperation and ability to work together helped make it possible for the complex to be completed on time," he said.

General Dynamics' Fort Worth Division modified the search radar to increase its jam resistance. The company used cost-effective techniques to produce the system six months ahead of schedule and $500,000 under cost, according to ESD officials.

The Air Force Communications Command installed the height finder,

***The Air Force HH-60D Night Hawk helicopter made its first flight recently. The Night Hawk will be the first new Air Force combat rescue helicopter type since the Vietnam era. See item.***

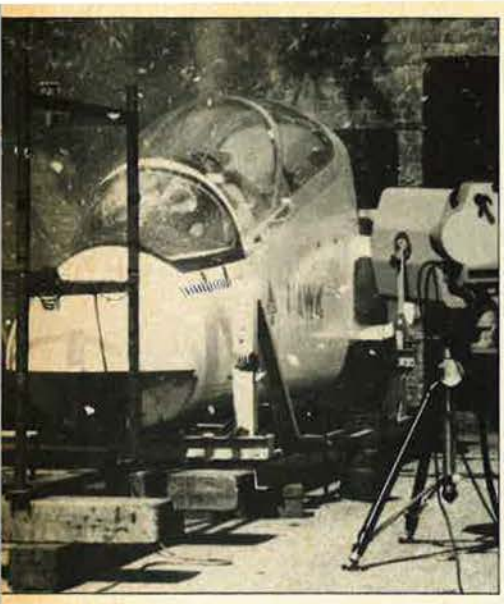
# Perceptions

The ability to grasp, then comprehend, the obscure is a key precept in electronic warfare problem solving. At Interstate, innovation, technology and experience provide forward-looking solutions to complex EW problems. Unparalleled expertise in signal analysis and processing. Innovative insights into $C^3CM$, ELINT and COMINT. Experienced $P^3I$ assistance. An outstanding QRC record. Interstate is well qualified to implement your EW systems. For details, contact: Director of Business Development, EW Systems, Interstate Electronics Corporation, P.O. Box 3117, Anaheim, CA 92803, Telephone (714) 635-7210.

***Interstate. Visionaries in electronic warfare systems.***

**INTERSTATE ELECTRONICS CORPORATION**

A Figgie International Company



*A bird hits an aircraft windscreen during performance tests of a new material made in Britain. The 610-mph test proved that a new acrylic and polycarbonate laminate screen developed by Lucas Aerospace increases the pilot's protection by stretching up to five inches on impact and then returning to its normal shape.*

and Hughes Aircraft Co.'s Ground Systems Group integrated both systems into Spain's air defense network.

Spanish Air Force engineers, assisted by Air Force civil engineers, designed and built the Barbanza site. MITRE Corp. advised ESD on equipment checkout, installation, and integration. All site activities in Spain were coordinated by ESD's Spanish Systems Field Office at Torrejon AB, Spain.

*Northrop Corp.'s third F-20 Tigershark recently passed a stringent Air Force inspection of the center and aft fuselage sections without a single defect. The third Tigershark is being completed at the company's Production Development Center in Hawthorne, Calif., where the entire fuselage was recently mated on schedule. See item.*

# AEROSPACE WORLD

★ The center and aft fuselage sections of Northrop Corp.'s third F-20 Tigershark have passed a stringent Air Force inspection without a single defect, according to Northrop officials.

The third F-20 is scheduled to join the Tigershark Flight Demonstration Program this spring. The first two F-20s have completed more than 500 flights with a mission reliability rate of ninety-seven percent.

"Passing an Air Force inspection with zero defects is obviously the best record that can be achieved in any program and is particularly impressive this early in a new aircraft program," said C. Robert Gates, Vice President and F-20 Program Manager.

"The Tigershark program has an outstanding record for quality which has consistently been validated by Air Force inspections," Mr. Gates added.

The Air Force has overseen the F-20 Tigershark program from the begin-

# INDEX TO ADVERTISERS

*Lockheed technicians make adjustments and record data during landing-gear actuation system tests for the new C-5B transport. Lockheed will begin assembly of the first C-5B this month and will deliver it to the Air Force in 1985.*

ning and has validated its performance, reliability, cost, and low logistic support requirements.

★ **NEWS NOTES**—SAC has decided **not to classify the KC-10 Extender as a combat aircraft;** thus, it joins the KC-135, EC-135, and E-4 as aircraft that are open to women pilots and other crew members. SAC expects to have a fleet of sixty KC-10s operating by late 1987.

The **419th Tactical Fighter Wing,** Hill AFB, Utah, is the **first AFRES unit to be equipped with the F-16 Fighting Falcon.** It received its first F-16 in late January. The 419th is also the last USAF unit to have flown the F-105 Thunderchief; retirement ceremonies for that aircraft took place in February. Last year—also in line with the Total Force concept—the **169th Tactical Fighter Group,** McEntire ANGB, S. C., became the **first ANG unit to receive the F-16;** it now has twenty-six. The active-duty Air Force is operating 675 Fighting Falcons.

An Air Force contract is expected to be awarded this summer for three new or used **Boeing 747s for conversion to heavy strategic airlift aircraft.** The successful contractor will provide the aircraft, all modifications, peculiar support equipment, training, and technical data and manuals. To be designated **the C-19A,** the converted aircraft will be stationed at Stewart Airport, Newburgh, N. Y., for use by the 105th Military Airlift Group of the New York Air National Guard.



For the second straight time, **the 379th Bombardment Wing,** Wurtsmith AFB, Mich., won the **General George C. Kenney Award** for the best performance by a bombardment wing during an operational readiness inspection. The Kenney trophy is awarded twice annually and the 379th won both competitions in 1983. The unit, which also won the trophy in 1979, is the first ever to earn the Kenney Award three times.

A major new gallery devoted to aviation from 1919–39 opens this month at the Smithsonian's National Air and Space Museum in Washington, D. C. **Entitled "Golden Age of Flight,"** the gallery will highlight that adventurous period when aviation came of age—an era of air-racing, record-setting, and exploration.

**Died: Ken Ellington,** aerospace industry executive and former AFA National Director who also served on the Aerospace Education Foundation's Board of Trustees, after a long illness in Mount Pleasant, S. C., in January. The AFA Life Member was seventy-four. ■

# The B-1B Is Flying; Its Training Team Is Taking Off!

The complex training requ
ments for the B-1B demand t
best — the best combination
experience, capabilities a
resources.

That's why Link has team
with Rockwell International a
AAI Corporation. This combin
tion can assure the U.S. Air For
of a B-1B training system as a
vanced as the aircraft itself.

The Link/Rockwell/AAI tea
has the unrivaled specialize
technology needed to simula
this multi-role bomber and
complex on-board systems.

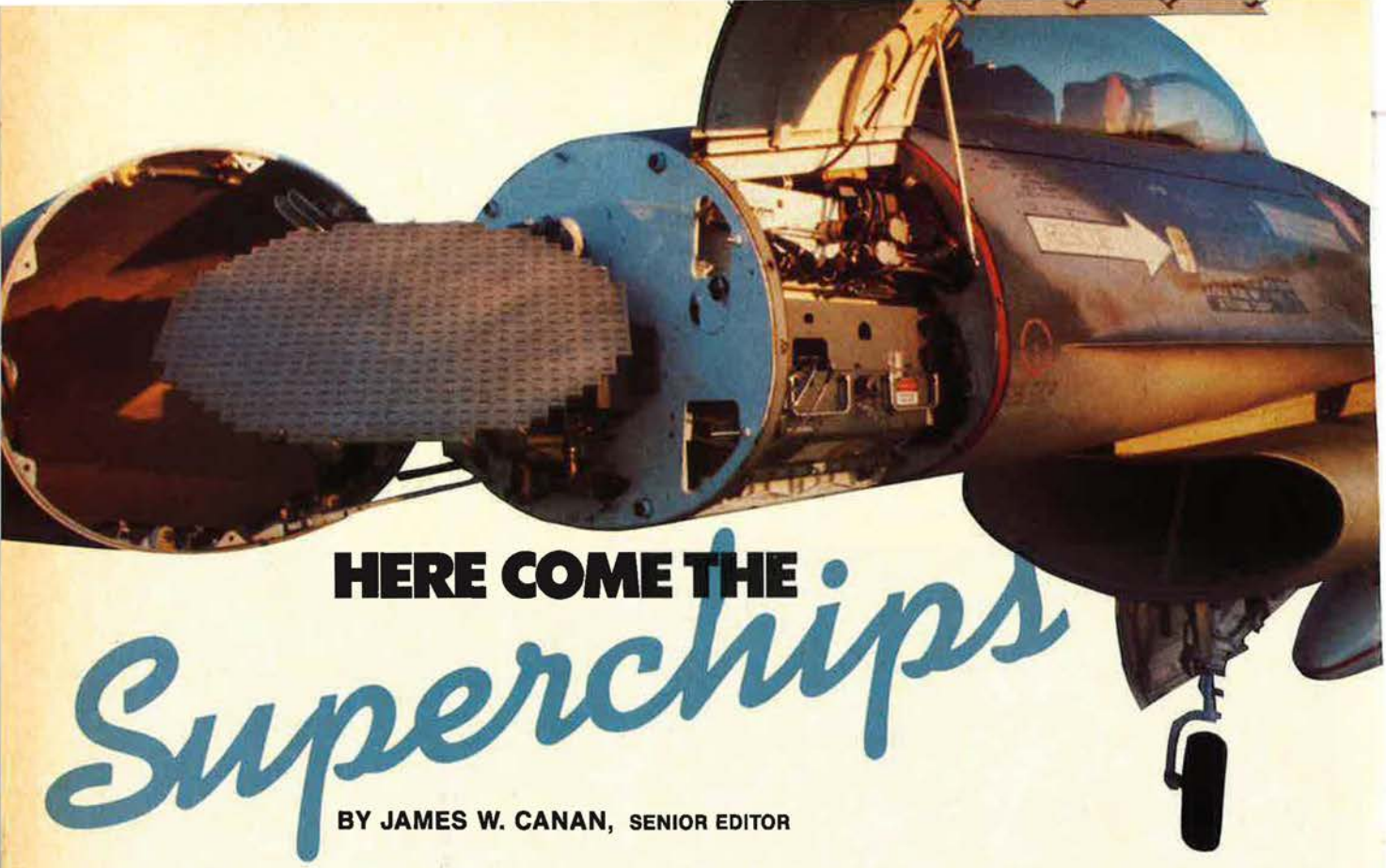
Link has built more training simulators than the rest of the industry combined. These include systems currently used by B-52 crews, providing integrated training similar to that required for the B-1B.

Rockwell, lead associate contractor for the B-1B, is currently in development and production of the actual aircraft. Rockwell can draw on its expertise in B-1B systems and simulation of aerodynamic flight characteristics to participate in mission requirements analysis for the B-1B simulator.

AAI, who is teamed with Link on the B-52 program, has an outstanding record for providing electronic warfare and tactical team trainers. They are the most logical choice to design and develop the B-1B simulator's defensive station.

## Link/Rockwell/AAI: a team of the best to assure the best!

Link Flight Simulation Division, The Singer Company, Binghamton, N.Y. 13902



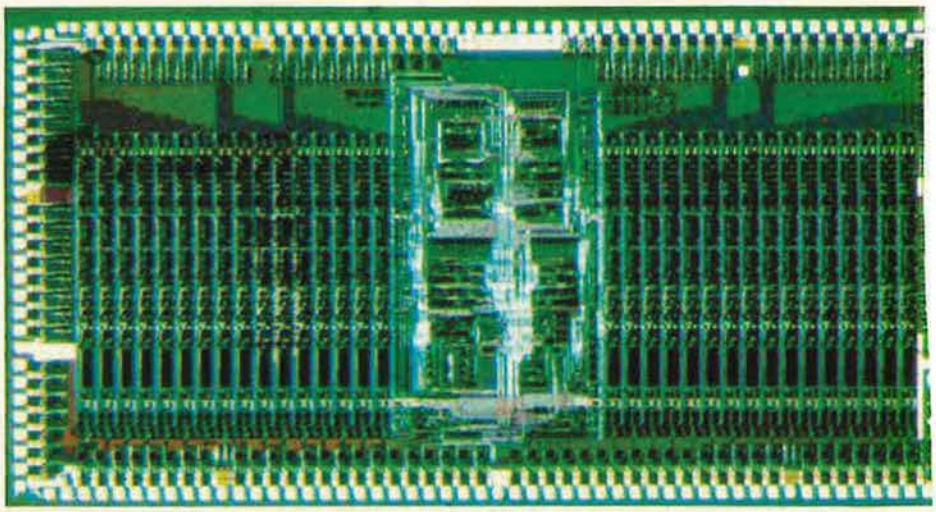
# HERE COME THE Superchips

BY JAMES W. CANAN, SENIOR EDITOR

The Air Force has big plans for VHSIC, which is being hailed as the biggest thing since radio.

THE Air Force will take the lead in finding out for real just how well the highly touted "superchips" now emerging from the triservice Very-High-Speed Integrated Circuits (VHSIC) program perform. A USAF airborne jammer, the AN/ALQ-131 electronic warfare pod, has been earmarked as the first operational system to be retrofitted with a VHSIC signal-processing computer.

The retrofitting is scheduled to begin no later than 1987. An awful lot will be riding on it. At a time of increasing dependence on the sureness and swiftness of signal and data processing in a plethora of military systems, the VHSIC chips are being hailed as the biggest thing since radio. The proof of their prowess will come, however, in their trial by deployment in operational systems under rigorous combat conditions.



*TOP: The electronic innards of an F-16 fighter is one place where microprocessors made up of chips from the VHSIC program are destined for deployment. ABOVE: A much-magnified section of a Westinghouse-Control Data microprocessor shows the intricacies of a densely packed VHSIC chip.*

## Promise of VHSIC

As of now, the prototype chips being fabricated by the VHSIC program's six prime contractors—Honeywell and Westinghouse with USAF, TRW and IBM with the Navy, and Texas Instruments and Hughes with the Army—seem to be living up to their promise. Officials in the services and in the Defense Department, which oversees the program, seem genuinely excited about the new, highly sophisticated semiconductors.

For example, Lt. Gen. Thomas H. McMullen, Commander of USAF's Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio, describes the VHSIC program as "one of the most prom-

ising programs at ASD—one that could revolutionize information-processing capabilities."

At Air Force Systems Command headquarters, Andrews AFB, Md., Capt. Thomas Hall declares that, from the evidence of its progress thus far, the program "will enable us to do tremendous things in terms of performance and logistics support" across a wide range of USAF systems, such as aircraft avionics and missile guidance. The program, he says, "is healthy—we will meet our goals."

Captain Hall's role is unique. USAF is the Defense Department's executive agent for administering the VHSIC program budget for all the services. Hall does that job in his capacity as AFSC's VHSIC Program Element Monitor.

The rosy assessment of the VHSIC program holds true at the top of the US defense establishment as well. Last February, in his Annual Report to Congress, Defense Secretary Caspar W. Weinberger said that "under the VHSIC program we have made significant progress in developing microchips that will greatly enhance the processing capability of military equipment."

Weinberger continued: "During the past year, for example, we developed and demonstrated 1.25-micron circuits that will provide the basis for new generations of equipment. Several systems have been selected by each service for demonstrating the application of this technology. Our goal is to incorporate VHSIC technology into defense systems at the earliest possible stage. . . ."

There is a sharp sense of urgency about such incorporation. In the strategic and tactical arenas, from ocean bottom to outer space, in weapons and $C^3I$ systems galore, signal-processing proficiency—or the lack of it—could spell life or death for US military forces in the new age of electronic warfare and highly automated weapon systems.

As summed up by Dr. Richard D. DeLauer, Under Secretary of Defense for Research and Engineering: "Electronic warfare means signal processing."

## A Quantum Leap

In that respect, the VHSIC chips hold promise for a quantum leap forward—of microchips densely packed with miniaturized integrated circuitry capable of processing signals and data fifty to 100 times faster than is now possible in military computers. Their capacious circuitry will also make them highly conducive to programming, thus providing new opportunities for the military in the use of weapon-system software.


***USAF's AN/ALQ-131 airborne jamming pod, here aboard an F-16, will be the first operational military system to incorporate VHSIC-based signal processors.***

Moreover, microcomputers utilizing VHSIC chips are expected to be much more reliable than those now deployed. Computer breakdowns result most often from faulty interconnections among component semiconductor chips and among the numerous circuit boards and boxes that make up a typical system. Just a few VHSIC chips—or even only one—will make up microcomputers capable of performing the myriad functions now requiring many chips, thus cutting down on connective wiring.

USAF has big plans for the VHSIC chips. Its leaders are convinced that those chips will be the touchstones for the total integration of aircraft avionics. So USAF is proceeding apace in selecting systems for VHSIC application. The airborne jammer will be the first, but four others have also been selected, and many more—some of them under consideration at this writing—will soon follow.

Those chosen as starters, besides the jamming pod, are a launch-and-leave bomb, a modular avionics suite, a general-purpose computer, and a common signal processor.

Except for the bomb, all are tied into the Advanced Systems Integration Demonstrations (Pave Pillar) program being carried out by ASD's Avionics Laboratory at Wright-Patterson AFB. That program, in all its many ramifications, cries out for VHSIC chips—and not just because of their processing speed.

Dr. Bernard Kulp, AFSC's Chief Scientist, puts it this way: "One of the big payoffs in Pave Pillar, which is the VHSIC-based integration of all the avionics going into our airplanes, is indeed a maintenance payoff."

For example, in applying VHSIC technology to a modular avionics suite, USAF aspires to ease of logistics as much as it does to signal-processing speed. Such a suite would embody a set of common microprocessors and other functional modules, greatly reducing the number of unique hardware designs and spare-unit types in such a suite.

The rewards in reliability, redundancy, and accessibility to the modules for maintenance could be tremendous. Such an avionics suite, now being investigated by General Dynamics under USAF contract, could take USAF a long way toward its goal of two-level, rather than three-level, maintenance of combat aircraft.

Reliability is also the catchword in the coming connection between VHSIC chips and USAF's AN/ALQ-131 jamming pod. "The total emphasis in that program is on availability and reliability, as opposed to putting any more functions into the pod," declares Sonny Maynard, the

Defense Department's VHSIC program manager. "The [VHSIC] insertion is principally aimed at reducing the need to have to repair—to redo—the digital section of the jammer, and at making it much easier for the technicians to maintain."

The VHSIC chips will mean much to future bombs and missiles too. In applying them to the guided bomb, as a preplanned product improvement ($P^3I$) program, USAF intends nothing less than a transformation of the bomb into a next-generation weapon.

Built by Texas Instruments, it is now called the Low-Level Laser-Guided Bomb (LLLGB). Its sensor, which seeks out a laser spot on a target and thus requires target designation by a laser on the ground or aboard the aircraft, will be replaced by an Imaging Infrared (IIR) sensor possibly more advanced than the one developed for USAF's air-to-ground IIR Maverick missile.

The bomb's IIR sensor will operate in concert with a VHSIC microprocessor. Putting them both on a bomb will be possible, says Captain Hall, "because VHSIC technology allows us to get enough processing power in a package that will fit" inside the weapon. "The whole idea," he says, "is to do away with that laser. This can do great things for the survivability of the [launching] aircraft."

*TOP: The Navy plans to put VHSIC chips into signal processors aboard a variety of antisubmarine warfare (ASW) platforms, such as the P-3 patrol aircraft. ABOVE: VHSIC-based microprocessors will also transform such current-generation weapons as the Army's TOW antitank missile.*

### Sensors and Signal Processors

This program exemplifies the interdependence, in their development and deployment, of modern sensors and signal processors. Signal-processing computers small enough to fit into missiles are not fast enough to take full advantage of the data from the various kinds of exotic sensors—such as the mosaic infrared and millimeter-wave radar varieties—now being developed. They are not up to the job of processing the continuous, copious signals that those sensors are capable of sending them.

This is why William J. Perry, during his term as Under Secretary of Defense for Research and Engineering, flatly declared that "without VHSIC, fully autonomous missiles will not be possible."

The Army and the Navy have high hopes for autonomous missiles as well, thanks to the VHSIC microprocessors. For example, the Army hopes to remake its TOW antitank missile.

To hit its target, the TOW must now receive computer guidance signals through a hair-thin wire that plays out from its launcher. This requires the soldier with the launcher to keep its optical sight on the target, thus exposing himself (in the same manner as a laser-designating aircraft) to hostile fire. With a VHSIC microprocessor inside the TOW itself, the Army will be able to do away with the wire and let the soldier take cover.

For VHSIC application, the Army has also selected a helicopter signal processor, a ground-vehicle signal processor, a threat-warning signal processor for its Patriot surface-to-air missile, and the helicopter-fired Hellfire antitank missile.

### Naval Applications

The Navy, too, has selected five systems in which it plans to implant VHSIC signal processors at flank speed. Tops on the list is the Enhanced Modular Signal Processor (EMSP) that it is now developing as its next-generation standard antisubmarine warfare (ASW) and elec-

tronic warfare computer. But even before VHSIC chips start showing up in the EMSP, now in the preproduction phase, they almost certainly will find homes, through retrofitting, in the "Proteus" computer that now processes signals from a wide variety of submarine-detecting sensors on ocean floors, in sonobuoys, in submarines, and in sonar arrays towed by ships and dipped from helicopters.

The Navy also plans to adapt VHSIC microprocessors to the Advanced Lightweight Torpedo now in development. Moreover, like USAF, it is in a hurry to get them airborne—in its F/A-18 aircraft's programmable radar signal processor and in its AN/AYK-14 standard airborne avionics computer.

A spokesman for the Naval Electronics Systems Command, which runs the Navy's segment of the tri-service VHSIC program, declares that "there really is no end to the possibilities" for VHSIC application to naval systems in the years ahead.

Right now, a great deal of the Navy's emphasis on such application lies in the ASW arena. Navy sources say that new classes of Soviet nuclear attack submarines—notably those of the *Mike, Sierra,* and *Victor III* classes—are posing "a terrible problem," as one such source puts it, for US ASW forces.

Those submarines are much quieter than their predecessors, largely because the Soviets, sources say, have learned how to keep their noisy drive machinery from resonating against their inner hulls, and how to muffle the sounds of that machinery in other ways, too.

Thus the Navy is busily upgrading its far-flung ASW acoustic sensors. Such upgrading will go for naught however, unless the ASW signal-processing computers at shore stations, in submarines, in patrol aircraft and helicopters, and on ships are also commensurately improved. To the extent that the ASW sensors become more proficient at picking up the slightest of undersea sounds, so will their associated signal processors need to get better and faster at translating those sounds into digital data and at sorting out the ones made by transiting Soviet submarines.

Enter the VHSIC microprocessors. "The VHSIC program is looking more important all the time," asserts William D. O'Neil, Chief of Naval Warfare and Mobility R&D in the Office of the Under Secretary of Defense for Research and Engineering.

### Finding Things and Hiding Things

O'Neil, a self-professed "VHSIC enthusiast," goes on to say: "More and more, war is becoming a race between the technologies of finding things and the technologies of hiding them. VHSIC technology has a key place in both. It leads directly to better—and cheaper—sensors, as well as to better ways to combine the inputs from many dispersed sensors. At the same time, VHSIC technology has a big role to play in hiding things by giving us smarter ways to blind or fool enemy sensors."

Moreover: "With VHSIC applications, we will be able to make missiles and other weapons a lot simpler—simple mechanical systems with electronic-logic controls telling them what to do."

The six prime contractors in the VHSIC program clearly hope to take advantage of their associations with the respective services by selling them VHSIC chips for systems that the contractors already build or are developing. For example, Westinghouse, a USAF VHSIC contractor, is also a major USAF airborne radar contractor and would like to see its chips, once they are in production, find their way into its own USAF radars. Likewise, IBM, a Navy VHSIC contractor, builds the standard Navy ASW computer for which it is targeting its VHSIC chips.

Each of the services will be free, however, to buy VHSIC chips and VHSIC-based microcomputers from any or all of the contractors, their current one-on-one affiliations notwithstanding, and even from companies that are not a part of the VHSIC program. Many such companies are investing their own capital, sans Pentagon contracts, in designing and building VHSIC-type semiconductors.

The VHSIC program has stirred "tremendous interest" in companies not presently associated with it, asserts Dr. Edith Martin, Deputy Under Secretary of Defense for Research and Advanced Technology under Dr. DeLauer.

"We have accomplished with the VHSIC program in fact what we intended to do," Dr. Martin says, "and that was to put in place, in the US manufacturing domain, the capability to provide state-of-the-art, VHSIC-quality chips and chips that meet our VHSIC-program parameters so that they can be used for government purposes. Many companies that are outside of the VHSIC program have picked up on it because they realize that they've got to be able to compete [with the VHSIC contractors] in the future."

All of the Pentagon's VHSIC contractors want to market their chips to more than one of the services. For example, Honeywell, although a USAF VHSIC contractor, proposes to provide the Navy with its VHSIC chips for incorporation in the Advanced Lightweight Torpedo being developed by Honeywell. Texas Instruments, an Army VHSIC contractor, is aiming its VHSIC chips at the guided bomb that TI is transforming into an autonomous weapon for USAF. TRW, a Navy VHSIC contractor, would like its chips to go into the electronic warfare pod that TRW is modernizing under contract to USAF's Air Logistics Center at Robins AFB, Ga.

### Phase One

Such freewheeling marketing of VHSIC chips across all the services was foreordained by Congress when it approved the initial funding for the VHSIC program in 1979. The lawmakers decreed that the technologies developed in the program at government expense must not become the exclusive property of the contractors to be selected for designing the chips.

The Pentagon willingly agreed. It wants all possible aerospace-electronics companies and semiconductor houses to have access to VHSIC chip designs and fabrication techniques, so long as its contractors' proprietary interests do not suffer in the bargain.

The $680 million VHSIC program settled into stride in 1981 when the six prime contractors were selected to execute its current phase, called Phase One. In concert with associ-

*By applying technologies for large-scale integrated circuits, Rome Air Development Center has pioneered the Monolithic Microwave Integrated Circuits (MMIC) in this module.*

ated contractors, each of the primes is applying one or more of several different design and fabrication techniques in building silicon-based chips that embody as many as 100,000 transistors and circuit lines miniaturized to diameters as small as 1.25 microns. One micron—or micrometer—equals one forty-millionth of an inch, or one millionth of a meter. Human hair averages four microns.

The dimensions of circuitry now implanted in military semiconductors range from five down to three microns. Thus the much tinier circuitry being devised in the VHSIC program permits a great deal more of it to be implanted in a chip the size of a contact lens. This makes the VHSIC chip denser, enables it to transfer electrons and process information prodigiously, and thus greatly enhances its "yield."

Because of its density and its superabundance of circuitry, a VHSIC chip is—*ipso facto*—a so-called Very-Large-Scale Integrated (VLSI) circuit. Some VLSI circuits existed prior to the VHSIC program. But the military did not have them, and they were not built for the speed or for the heat resistance and radiation tolerance that the military now insists on.

In fact, the VHSIC program was set up in the late 1970s under William Perry for the express purpose of stimulating aerospace-electronics companies to build high-speed chips specifically for the armed services. It had become all too obvious that the Soviets were rapidly closing the US lead in microelectronics, the one technology in which the US had been thought to have an insurmountable advantage—and maybe the one that matters the most.

In the summer of 1981, the Defense Science Board, following a study of US military technology programs, issued a report listing seventeen of them that the DSB said "could make an order-of-magnitude difference" in future US military capability. That list was dominated by technologies having to do, in one way or another, with electronic warfare. At the top of it, ahead even of the second-ranking Stealth technology for making aircraft virtually invisible to radar in some aspects, was the VHSIC program.

Ever since, that program has been described by DoD's Dr. DeLauer as "our top-priority technology program." So it remains, with no change in sight.

### Technology Insertion

Once it became apparent in the early 1980s that the VHSIC contractors would indeed be capable of producing chips that met program specifications, the emphasis shifted to "technology insertion"—getting those chips into deployed and developing military systems post-haste.

In a directive to a special task force (headed by Perry) that Dr. DeLauer formed to study the VHSIC program, the Defense Department's research and engineering boss wrote that "it is imperative that the program be optimally planned and executed" because "its implications are so pervasive and so important to the defense posture of this country."

Furthermore, Dr. DeLauer stressed the urgency of incorporating the chips in weapon and other systems much more quickly than the ten years or so that US technology insertion all too often takes.

So the Perry task force came up with the idea of VHSIC technology insertion funding. That funding, a part of the $680 million total program cost, is expected to add up to $212 million. It goes to the services' managers of weapon and other systems for which VHSIC chips are destined. It is the managers' insurance against having to pay, out of their own program budgets, for initially retrofitting their systems with untried VHSIC semiconductors, or for altering their development programs, such as those for radars, in anticipation of the advent of those semiconductors.

This cuts their risk of stretchouts and resulting cost overruns and lets them continue to forge ahead with non-VHSIC semiconductors until the new varieties prove their mettle.

"They will be able to pursue parallel approaches—so if the VHSIC-based microprocessors aren't ready on time, they will still have fallbacks and won't lose any time or momentum in their programs," explains a Navy official.

### Phase Two

With the first of the VHSIC chips now realities, and with insertion funding for them in place, the next part of the program—the "submicron" Phase Two—is beginning. This one will be a real hummer.

In it, for openers, DoD and the services have signed up nine contractors (the original six plus Western Electric, Harris Corp., and RCA) to study ways of designing and fabricating VHSIC chips packed with millions of transistors and other microelectronic devices of almost infinitesimal, half-micron dimensions.

Those chips, their electron-switching "gates" operating at incredible speeds, will be capable of billions of arithmetical operations per second. They will have so many transistors and circuit lines that they are expected to be able to diagnose their own faults and to self-test failures.

Semiconductors of such awesome capability will be necessary, says a Defense Department document, "to maintain our position of military preparedness in future weapon systems." As examples of such systems slated for Phase Two chips, the document lists:

- " 'Brilliant' autonomous munitions."
- "Wide area ocean surveillance."
- "Zero CEP weapons."
- "Battlefield management."
- "$C^3I$ 'trusted' systems."

• "Artificial-intelligence 'engines.' "

Those chips will not come easily. The intricacy and the capaciousness of their circuitry presumes pioneering methods of design and fabrication, all governed by computers and very likely involving the employment of manufacturing robots.

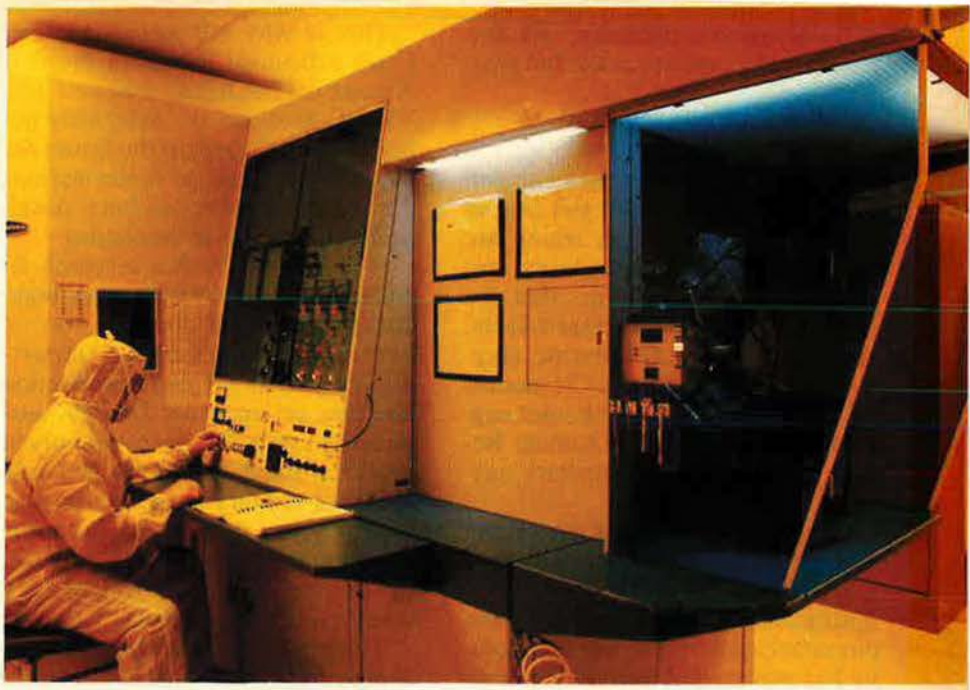
"It's a major step," Dr. Martin declares. "The contractors will have to do things much differently than they are now doing them."

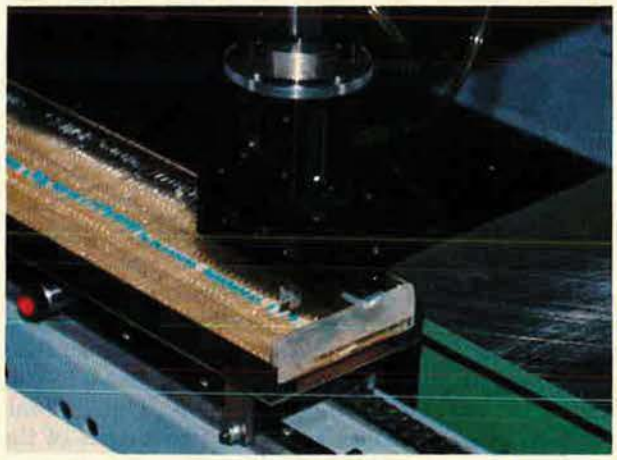
A major reason for this is that current techniques for embedding transistors and other features on layer after layer of silicon in a tiny semiconductor chip rely on optical lithography. For the Phase One VHSIC chips, that does the trick. But in the Phase Two VHSIC chips, those transistors and other submicron features will be so small as to be undetectable—and unmanageable—by optical instruments.

### Challenges for Phase Two

"It's a much different ball game," says AFSC's Dr. Kulp. "Optical lithography won't do it. We'll have to go to X-ray and electron-beam kinds of lithographies." But Dr. Kulp is "optimistic" that it can be done: "The VHSIC program is developing the lithographic equipment to do it, and the R&D to do it. It's taking the risk out of it, so now a company can say, 'Yes, I want to make half-micron chips. How do I do it, and how much is it going to cost?' Those are the questions that the VHSIC program is answering. It isn't going to buy lithographic equipment for any of the companies to build the half-micron circuits, but it is going to say, 'Here's what you can buy, here's what will do it.' It puts up the R&D money to enable the industry—at a well-understood risk—to produce these chips."

Some R&D officials fear that silicon, the material used for building all semiconductors (including those in the VHSIC program's Phase One), may not be a sufficiently good conductor of electrons to process them at the speeds and in the profusion that the Phase Two VHSIC chips are designed to provide. It may be necessary, they say, to turn to another material, such as gallium arsenide (GaAs), which offers five times as much electron mobility, needs less voltage, can operate at higher frequencies, and tolerates heat (and radiation) much better than silicon.





***ABOVE: An ion-implantation machine embeds materials in a semiconductor wafer. This process will be useful in the VHSIC program's submicron phase. LEFT: A Material Accountability and Robotic Kitting (MARK) system helps assemble semiconductor components in radar and ECM-pod circuit boards. Both machines belong to Westinghouse.***

The Pentagon intends to stick with silicon, however. "There have been so many billions of dollars poured into silicon technology that, basically, most of us are comfortable that we can do what we want to do in silicon," Dr. Kulp asserts. "So I believe that any problems involving materials can be solved with silicate material—down to half a micron. Below that, I won't predict."

There is also some concern in the operational community that the VHSIC chips, because of the intricacy and delicacy of their design and construction, will not stand up well under rough-and-ready combat conditions. This concern is dismissed, however, by officials with expertise in microelectronics. In fact, one such official, Lt. Col. Mike Borky of AFSC, declares that the VHSIC chips are "good news" in terms of durability.

The reason, Colonel Borky explains, is that in military microprocessors, the VHSIC chips will allow for "fewer circuit boards, fewer interconnections, and smaller black boxes." Such compactness, he adds, "will make it easier to protect them against environmental effects."

Hardening the chips against such nuclear effects as radiation and electromagnetic pulse (EMP) may be another matter. Ways of doing this are being studied by the Defense Nuclear Agency, with promise of success.

"We are well into our efforts to develop chips with radiation hardness protection for tactical, strate-

gic, and space application," Dr. DeLauer told Congress early this year.

### Gallium Arsenide for Survivability?

In the end, however, the Pentagon may have to resort to the use of gallium arsenide chips, which are intrinsically hardened against nuclear effects, in systems that are most susceptible to nuclear effects, such as satellites and airborne, shipborne, and land-based $C^3I$ nodes. Defense Secretary Weinberger suggested as much in his Annual Report to Congress last February, saying:

"The survivability of electronic equipment in hostile environments will be enhanced by advances in radiation-hardened gallium arsenide circuits. Gallium arsenide technology has progressed beyond the laboratory stage to a pilot-line fabrication facility that produces up to 100 wafers [from which chips are cut] a week. This technology has important potential application for space-based systems."

Those systems are becoming more sophisticated and vital to US strategic and tactical forces all the time. They must be protected against antisatellite attacks that the Soviets are now capable of mounting against them in low-earth orbit—and later, presumably, against those in geosynchronous orbit as well. Such protection will be provided, the Pentagon hopes, by the US ASAT IR homing weapon, launched by F-15s, that USAF began testing last January. It would be comforting, however, if US satellites were capable of sensing danger and of maneuvering out of harm's way.

For that, they will need very-high-speed microprocessors to give them, much like future missiles, autonomous reaction and control. This capability could be an absolute necessity for ASAT or ABM laser battle stations in space, such as those now being contemplated as part of the Administration's Strategic Defense Initiative (SDI) program. Furthermore, such stations would certainly need superswift microprocessors of the VHSIC generation in order to handle their functions of targeting, tracking, aiming, firing, and retargeting at a multitude of missiles, all in a twinkling.

This is why officials of the Defense Advanced Research Projects Agency (DARPA) regard the VHSIC program as "extremely important," says one, to the future deployment of the laser battle stations for which DARPA has been developing a range of technologies.

It is in DARPA that research on gallium arsenide VLSI, very-high-speed integrated circuits, too, is centered. The Defense Department's gallium arsenide production line was set up under DARPA auspices last year. Its goal is not only to produce small quantities of GaAs chips for military purposes but also to contrive, in concert with the semiconductor industry, ways of producing the chips in quantity while cutting their costs.

The big problem with gallium arsenide chips in the past has been the very high cost of their production—at least ten times as much as for silicon chips. Moreover, its fundamental material properties make silicon inherently easier and less expensive to work with.

### Testing the Chips

Long before the VHSIC-program chips or any other types of comparable wonderworking semiconductors are implanted in operational military systems, the services must test them on the ground. This could be a problem. The 1.25-micron chips from Phase One of the VHSIC program—to say nothing of the half-micron chips to follow later this decade—will be so dense and fast as to overwhelm the capabilities of existing testing equipment. The plain fact is that the services do not now have equipment to test VHSIC devices effectively.

For USAF, such testing is the province of the Rome Air Development Center at Griffiss AFB, N. Y. Maj. Rudolf R. Konegen, RADC's VHSIC program manager, acknowledges the dilemma.

"The chips are becoming so fast and complex that they tax our ability to get our arms around them. The manual test engineering methods of the past won't do it. It's important that the manufacturers themselves be able to test their chips thoroughly and efficiently, and that we [at RADC] receive new equipment and supporting software to follow up."

Things are happening, however. ASD's Materials Laboratory was preparing, early this year, to award a contract for new semiconductor testing equipment for RADC that could cost as much as $5 million. Fully automatic, itself dependent on embedded computer control, that equipment is expected to be far more sophisticated and capable than any presently available on the commercial market.

In addition, RADC, in cooperation with sister laboratories in the Army and Navy, will award contracts totaling as much as $5 million to develop software that will automate the process of generating test-specification requirements and testing programs for VHSIC Phase One devices. When fully developed, this software will extend VHSIC computer-aided engineering techniques into the test-engineering arena.

As it prepares to test the VHSIC program's Phase One silicon-based chips, RADC is also looking ahead to its future need to test the chips from Phase Two and, very likely, gallium arsenide varieties as well.

"We're beginning to investigate the reliability and testing ramifications of the gallium arsenide integrated circuits, but we haven't got to the point yet where we need to concentrate hard on them," explains 2d Lt. M. Stephen Karlovic, RADC's VHSIC testing project manager.

RADC is giving a whole lot of thought to the advent of the Phase Two chips, however. In devising hardware and software for testing those chips, says Major Konegen, "There may be a terrible problem—making the test equipment as fast as the chips themselves." He adds: "If we don't have adequate testing equipment, we'll have no way of knowing whether the chips have achieved their required design performance—and beyond that, of knowing what additional capabilities they may have achieved."

Thus it may come to pass that the manufacturers and the military services are forced to rely heavily on the Phase Two chips' own self-contained diagnostic and testing capabilities. In a sense, this would mean that even as the chips become a means of making weapons fully autonomous, they also become almost fully autonomous themselves. ■

# THE LABS MOVE INTO THE MAINSTREAM

**Merging the laboratories into the product divisions has shortened the lead time on operational technologies.**

BY JAMES W. CANAN
SENIOR EDITOR

WILL USAF's laboratories and their contractors come up with the technologies needed to build a horizontal-takeoff, multimission spacecraft? A totally integrated advanced tactical fighter? A single-warhead ICBM that is smaller than MX but just as accurate and far-ranging? A land-mobile launcher vehicle for that missile capable of withstanding a nuclear blast? A high-energy, space-based weapon system? Systems embodying artificial intelligence?

Given the track record of those laboratories, they very likely will.

But will those technologies and many others be mature enough when needed? Is their development being coordinated and expedited with all possible efficiency? Does anyone really know how they all can be made to converge, and when?

The answers to those questions are affirmative to a far greater degree than would have been possible just a few years ago. The reason: Throughout USAF, from laboratories to operational commanders, there is great and increasing emphasis on tightening the connections between new technologies and the systems that are destined to incorporate them.

## Out of the Sandbox

With good reason. For many years, US defense officials have chafed at the excruciatingly long time it has taken to adapt new technologies to weapon systems. That process has consumed, on the average, at least ten years.

Military laboratories have often been accused of lack of focus—of languorously "playing in the sandbox" of scientific inquiry without much thought to applying the fruits of their research to systems. Systems managers, on the other hand, have been accused of indifference to—or studied ignorance of—the work of the labs.

Until a relatively few years ago, discussions of how to solve the problem of laggard application of technologies had the overtones of a parlor game. US systems were technologically superior to those of the Soviet Union in nearly all respects, so why get too excited? In the late 1970s, however, it became obvious that the Soviets were catching up fast in developing and applying many military technologies, such as, for example, the microelectronics needed for look-down/shoot-down radar. So the Defense Department and the military services began ascribing top priority to "technology transition."

In USAF, at least, such emphasis is beginning to pay off. The key to the payoff is the improved teamwork between the people in laboratory smocks and those in blue suits who are responsible for building new weapons, modernizing old ones, and using all of them.

The general officers who command Air Force Systems Command's product divisions now know, much better than ever before, just how the projects AFSC's laboratories are working on will contribute to the enhancement of weapons and other systems being engineered, produced, or planned by the divisions. Those generals also have a direct say in which of those laboratory projects should be given priority.

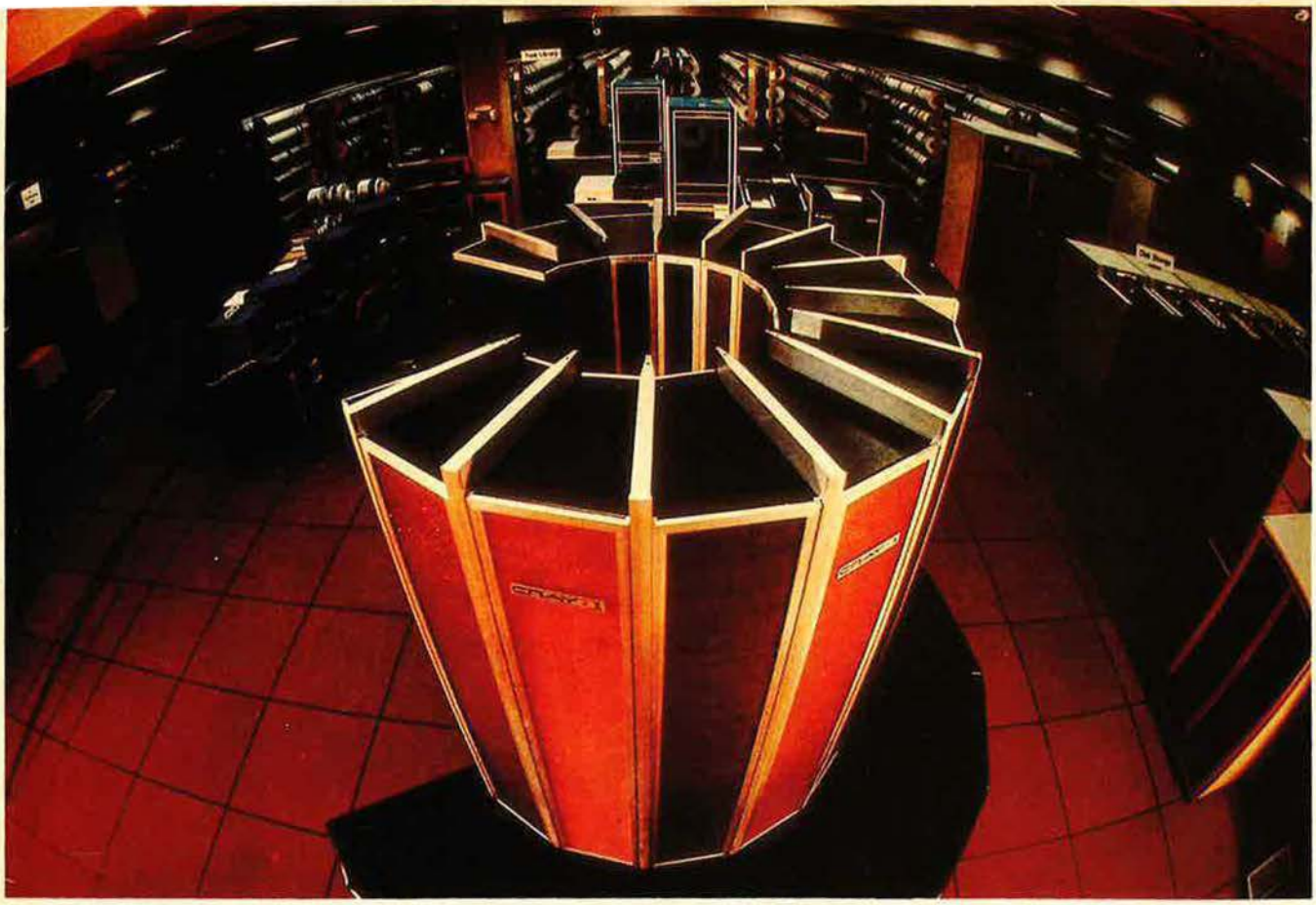
It works both ways. The directors of the laboratories, too, now know precisely where the product divisions are heading in terms of new and improved weapons, and thus can arrange their technology thrusts accordingly. In fact, the directors are much better able, nowadays, to help shape the requirements and specifications for new and future weapons by keeping the product divisions up to date on emerging technologies.

—Photo by Walt Weible

*USAF's labs are exploiting automation in development of new technologies. Here, a robot works on a microchip.*

## Laboratory Realignment

"Our laboratories are no longer second cousins," asserts Brig. Gen. Philippe O. Bouchard, AFSC's Deputy Chief of Staff for Science and Technology at Andrews AFB, Md.



*This CRAY-1 computer epitomizes USAF's increasing need for advances in computer speed and capacity. The "supercomputer" now being developed by the Defense Advanced Research Projects Agency (DARPA) will feature even greater speed and capacity and will embody multiple, parallel data-processing units. Vast expansion of computer capabilities will be conducive to the application of artificial intelligence (AI) programming now under intensive study in USAF laboratories.*

"They're part of the first team. They are enthusiastic about being in a better position to hand off their work to the product people and the users."

The reason for this is the realignment of AFSC's laboratories under its product divisions, a move that goes far beyond the merely administrative changeover that it seemed, at first glance, to be.

Gen. Robert T. Marsh, Commander of AFSC, ordered the realignment in October 1982. It completed a linkage between labs and divisions that was already partly in place.

AFSC's Armament Laboratory at Eglin AFB, Fla., had been organic to AFSC's Armament Division (AD) at Eglin for some time. This was also true of AFSC's Rome Air Development Center (RADC) at Griffiss AFB, N. Y., an acknowledged adjunct of the Electronic Systems Division (ESD) at Hanscom AFB, Mass. Under General Marsh's order, all nine remaining AFSC laboratories were put under product divisions.

Space Division (SD) at Los Angeles AFS, Calif., enfolded AFSC's Geophysics Laboratory at Hanscom, its Weapons Laboratory at Kirtland AFB, N. M., and its Rocket Propulsion Laboratory at Edwards AFB, Calif. These laboratories, none of which was physically relocated, compose AFSC's Space Technology Center at Albuquerque, N. M., which was activated at the same time that the laboratories were realigned.

A month earlier, in September 1982, USAF had activated its new Space Command at Peterson AFB, Colo. The increasing interplay among all those USAF space-oriented elements stands as a striking example of the service's latter-day emphasis on bringing new technologies speedily into play.

Gen. James V. Hartinger, Commander of Space Command, sums it up: "So we now have an efficient cradle-to-grave autonomy—from basic technology at Albuquerque; to research, development, acquisition, and on-orbit checkout by Space Division; to on-orbit control, management, and protection by the operational Space Command.

"We realized," General Hartinger continues, "the uniqueness of space systems and the requirement for a close tie between the technologist, the developer, and the operator. . . . Our objective is to establish a relationship between the Space Command and the AFSC Space Division that will make it difficult to tell where one starts and the other stops."

Right now, the Space Technology Center laboratories are heavily into work on technologies—and on defining options among them—for responding to President Reagan's call for a new, nonnuclear Strategic Defense Initiative (SDI) program for defending the US against ballistic missiles. Technologies of such weapons as high-energy lasers—with growing emphasis on the

ground-based, short-wavelength varieties—are being expedited. Those technologies span the realms of lasers, microelectronics, optics, and materials. All bear on target acquisition, target tracking, fire control, and command and control—elements that must be pulled together in one package to make a workable weapon system out of a high-energy laser device.

To complete the merger of laboratories with product divisions, General Marsh decreed that Aeronautical Systems Division (ASD) absorb the collocated Air Force Wright Aeronautical Laboratories (AFWAL) comprising AFSC's Flight Dynamics, Avionics, Materials, and Aero Propulsion laboratories. Finally, AFSC's Human Resources Laboratory, with branches at Williams AFB, Ariz., Lowry AFB, Colo., Wright-Patterson AFB, Ohio, and Brooks AFB, Tex., and its Aerospace Medical Research Laboratory at Wright-Pat, were placed under its Aerospace Medical Division (AMD) at Brooks.

Keith I. Collier, Deputy Director of the AFWAL labs, says that "our merger into ASD, with its development objectives, excites us. It encourages us to focus on goals—to get technology into the field faster, and to integrate it as we go."

In keeping with this, ASD's laboratories have conceived four "major thrusts" in their work on aeronautical technologies for aircraft programs, such as USAF's Advanced Tactical Fighter (ATF) program that is rapidly picking up steam in its early development stage. Those major thrusts are sortie generation, supersonic persistence, night-in-weather attack, and space applications. With respect to space, the AFWAL laboratories are coordinating closely with their sister laboratories now constituting AFSC's Space Technology Center.

Overall, says AFWAL's Collier, "Our aim is to assure the availability of required technology capabilities to satisfy Air Force needs at specified times—to bring to bear the commitments and the resources within those times. What we have done is to develop a management process that will provide focus for AFWAL technology base programs."

There are some risks. Certain laboratories could become too closely beholden to certain product divisions. Moreover, technologies with high promise for near-term application could be overemphasized at the expense of others less urgent for now but indispensable for far-term systems.

AFSC is well aware of this, and is guarding against it. Even as he merged the laboratories with the product divisions most closely identified with them, General Marsh made clear that he wanted all the labs to continue to provide technological support across the whole range of product divisions.

For example, says General Bouchard, "The work of the Materials Laboratory at Wright-Patterson is to remain applicable to all the divisions, not just to ASD. That lab is producing materials for the Space Division and the Armament Division, and electronic materials for ESD as well. Like others, it is still a generic laboratory."

### Coordinating and Integrating

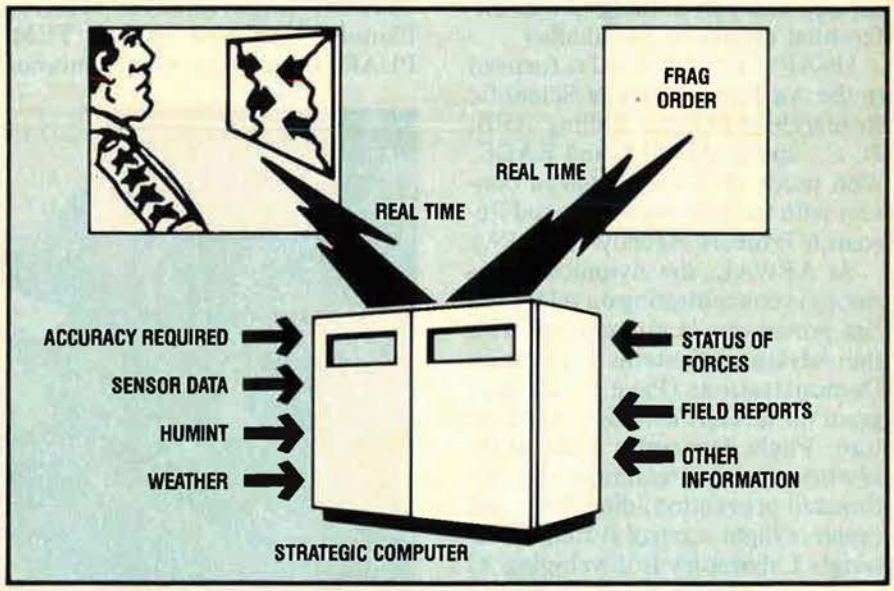
Coordination among the laboratories and across the product divisions is becoming more urgent all the time. More and more, the accent is on integrating all manner of technologies in all kinds of systems, be they fighters, spacecraft, missiles, or C³I networks and nodes. The idea is to plan ahead for such integration so that it can be done at the time of system design and all at once in development—not piece by piece, at one time or another.

This is why the terms "major military capability thrusts" and "major technology thrusts" have become nearly synonymous in the lexicons of USAF's R&D and systems communities.

Operating in the "real world" of systems requirements has long been the hallmark of RADC at Griffiss in its workaday alignment with ESD. But even at RADC, USAF's increasing emphasis on technology transition is having an impact. Take it from Col. Charles F. Stebbins, RADC's Commander.

"What we're trying to do," explains Colonel Stebbins, "is to make sure that as we begin an effort here, we start thinking immediately about future uses for it. I don't want to stifle our early technology work to the extent that when our people start looking into a technological area, they have to have a precise game plan for it in the future. But I do want them to start thinking about that right away. As the effort progresses from basic research through exploratory development and into advanced development, the degree of our planning—and our involvement with the users—needs to increase."

In this respect, RADC Chief Scientist Dr. Fred I. Diamond points out that, in the blurring of traditional lines separating the various




***Future combat commanders will rely on computers driven by AI software for battle management planning and for rapid replanning in real time. The computers will be able to define options and recommend appropriate actions.***

engineering and scientific disciplines, "the renaissance engineer" is emerging—at least where RADC's specialty, C³I, is concerned.

"He has to understand modern information theory, information science, modern control theory, solid-state physics—and a little bit of operations analysis and applied psychology wouldn't hurt, either," Dr. Diamond says.

RADC plays a major role in AFSC's development of artificial intelligence (AI), which could be a very big boon to C³I systems of the future. Many USAF researchers still refuse to describe AI as a technology because, they claim, its various elements are still very much in the basic research stage. Even so, its potential applications to a wide range of military systems are already—and with increasing enthusiasm—being devised.

### Artificial Intelligence

Grounded in sophisticated software, computer-based artificial—or "machine"—intelligence is defined in an AFSC document as "the process by which mechanical devices are able to perform tasks which, when performed by humans, require some thought." Examples of "expert systems" embodying AI software techniques are MYCIN and INTERNIST, which perform medical diagnosis; DENDRAL, which is used in analytic organic chemistry; and MACSYMA, which sets up and solves integral and differential equations in calculus.

USAF's research in AI is focused in the Air Force Office of Scientific Research (AFOSR), Bolling AFB, D. C., and at AFWAL and RADC, with much of it conducted in concert with the Defense Advanced Research Projects Agency (DARPA).

At AFWAL, the Avionics Laboratory is concentrating on AI for image processing in conjunction with the Advanced Systems Integration Demonstrations (Pave Pillar) program for aircraft avionics of the future. Flight Dynamics Laboratory is working on AI techniques for automated prevention, diagnosis, and repair of flight-control systems. Materials Laboratory is developing AI as a potential means of much greater automation in its manufacturing technology (MANTECH) program.

RADC's program is pegged to the development of AI techniques to support tactical battle management and is expected to be applied to command and control systems within the next ten years.

"I'll guarantee you," declares AFSC's General Bouchard, "that artificial intelligence is going to be the key to sorting through the information overload that the combat commander gets. It will help him answer the questions: 'What are my options?' 'What is my chance of success in each of my options?' It's going to be the means of fusing all that data that's pouring in from all those sensors we have out there."

AI systems could be especially important in helping the combat commanders "replan in real time for the second day of battle," General Bouchard continues, "when yesterday's plan has been altered by events—weather has socked him in here, an airplane went down over there, and so forth. AI will really pay off in helping the commander restore order from chaos."

### AI for Mission Planning?

Officials at RADC heartily agree. RADC has charge of an AI-software project called KNOBS (for Knowledge-Based Systems). It expands and applies rudimentary AI planning techniques that originated in earlier research on robotics. Now RADC is supervising the development of an advanced model of KNOBS called TEMPLAR, for Tactical Experimental Mission Planner. The goal for the TEMPLAR system is the kind of mission replanning to which General Bouchard refers.

As described by Dr. Northrup Fowler III, an RADC mathematician who is expert in AI work, "KNOBS would plan a mission—and then the time would come, a half-day later, when the world has changed and the mission has to be replanned—and it has become much more complex and time-stressed. The commander might not want to pursue all of his original goals. Other opportunities may have presented themselves. Instead of having twenty-four hours to schedule 1,000 aircraft, he might have just two hours to reschedule 500 of them, rearrange their weapons loads, and adjust their routes and refueling, for example."

An AI model for such quick-adjustment replanning is evolving in an RADC exploratory development program called GORP, for Goal-Oriented Replanner. Beyond it, RADC is working up "the third phase—moving into some sort of distributed planning environment where we might have three or four AI planners operating independently but through the same systems," Dr. Fowler explains.

Col. David L. Carlstrom, chief of command and control at RADC, believes that AI will have an expanding role in C³I systems during the next five to ten years. Because of the growing demands on them, such systems will necessarily become so complex as to require AI.

"You hear all this stuff about distributed data bases and distributed operating systems on distributed

*Researchers at the Air Force Weapons Laboratory at Kirtland AFB, N. M., test a high-energy laser. This lab is now part of AFSC's Space Technology Center.*

*Under a USAF study contract, Boeing developed the concept of an air-launched space sortie vehicle shown here. Several companies are now joining with USAF to devise a horizontal-takeoff, multimission, manned Transatmospheric Vehicle (TAV).*

hardware," Colonel Carlstrom says, "but my personal view is that you can't do all of that without AI."

Even though AI is coming along fast, and is likely to be designated as an AFSC "major technology thrust" in the near future, RADC officials agree that it is, as Dr. Fowler says, "not a technology and not yet a science." Rather, it is an assortment of "ideas about the fundamental nature of intelligence that are computationally manifested in a number of complex computer programs."

Yet there is little doubt among such officials that advances in computer software, such as the forthcoming standardization of military computer language, and in computer hardware, such as very-high-speed, very-large-scale integrated circuits and DARPA's new "supercomputer" development program, will be highly conducive to speeding up the development and application of AI systems.

"I'm accustomed to seeing technology evolve in an orderly fashion," declares AFSC's General Bouchard, "but I think that as we incorporate very-high-speed integrated circuits and artificial intelligence, we're going to revolutionize an awful lot of things. For example, instead of 'smart' weapons, we're going to have 'very intelligent' weapons."

The day is "not far off," adds a DARPA official, when military commanders, having come to realize what AI can do for them, "will start clamoring for it."

Meanwhile, it is the job of the laboratories, such as those of AFWAL and RADC, to keep those commanders posted on how AI is growing up—and when it will be ready for their use.

### Emphasis on Reliability

It is also the responsibility of the laboratories, in their tighter relationships with systems engineers and with users, to keep the reliability factor constantly in mind. They are no longer free to develop technologies without regard to the prospective difficulties of maintaining systems that will incorporate those technologies. On the contrary, ease of maintenance and enhanced reliability rank at least as high as operational performance in the labs' aspirations for their scientific and technological products.

Says General Bouchard: "Most of our laboratory people were very performance-oriented. They got their satisfaction out of really stretching the performance part of the technology. Now, however, they're thinking, 'I'll trade off a little performance to make sure that this technology is reliable.' That philosophy has spread throughout the labs. People working on new radars now brag as much about their long mean times between failures as they do about their ranges."

There is really nothing anomalous about that. As Dr. Bernard Kulp, AFSC's Chief Scientist, puts it: "There's a real sense of excitement in making things more reliable—in seeing the problem of unreliability in our systems yield to our research, to our creative people. Big strides are being made and projected by those people—order-of-magnitude strides. That is every bit as exciting as an order-of-magnitude increase in performance. It promises great things in logistics, and it gives our [laboratory] people the thrill of accomplishment." ■

# The Independent Infusion

Little known and much maligned, IR&D has a record of producing high-payoff technology.

**BY JAMES D. HESSMAN**

THE average man on the street has never heard of it, but it's been responsible for development of both the car and the tank, the pleasure boat and the battleship, the Boeing 747 and the B-1 bomber.

"It" in this case is Independent Research and Development, usually shortened in Defense Department circles to IR&D. Distinguished from but often complementary to government-funded RDT&E (research, development, test, and evaluation), IR&D has been variously defined as contractor-initiated R&D, company-funded R&D, and self-initiated and self-funded research and development carried out by the private sector.

Whatever the definition, two key points are always made: IR&D funding comes from corporate coffers, not from the federal government (but partial reimbursement is possible if the IR&D leads to products later procured by the government); and control of the R&D process is retained by the company funding the R&D—the company is free, in other words, to reduce or increase funding, or to cancel a program completely.

### "I" Is for Independent

Independence is the *sine qua non* of IR&D. The federal government, and particularly the Defense Department, benefits considerably from IR&D and, as suggested, sometimes ends up paying for a certain share of it. For that reason, there are proposals voiced from time to time in the executive branch or in Congress to exercise tighter governmental control over IR&D. That would, of course, take the "I" out of the IR&D; it also would be counterproductive. Considering that the Wright brothers, Edison, and Alexander Graham Bell are but a few of the literally tens of thousands of bright minds in the private sector who have made significant contributions to military readiness, it seems evident that the philosophy of "letting a hundred flowers bloom" has paid considerable dividends.

And it's more than a hundred flowers out there in the private sector. Defense Secretary Caspar Weinberger points out in his Fiscal Year 1985 "Annual Report to the Congress" that there are now "between 25,000 and 30,000 private-sector prime contractors throughout the United States doing business with the Department of Defense (DoD)," while the government itself "owns only seventy-two defense production plants, of which

fourteen are in 'layaway' status for emergency use." Add to those prime contractors an estimated 50,000 or so major subcontractors, and it becomes clear that the feds have no monopoly on scientific brainpower.

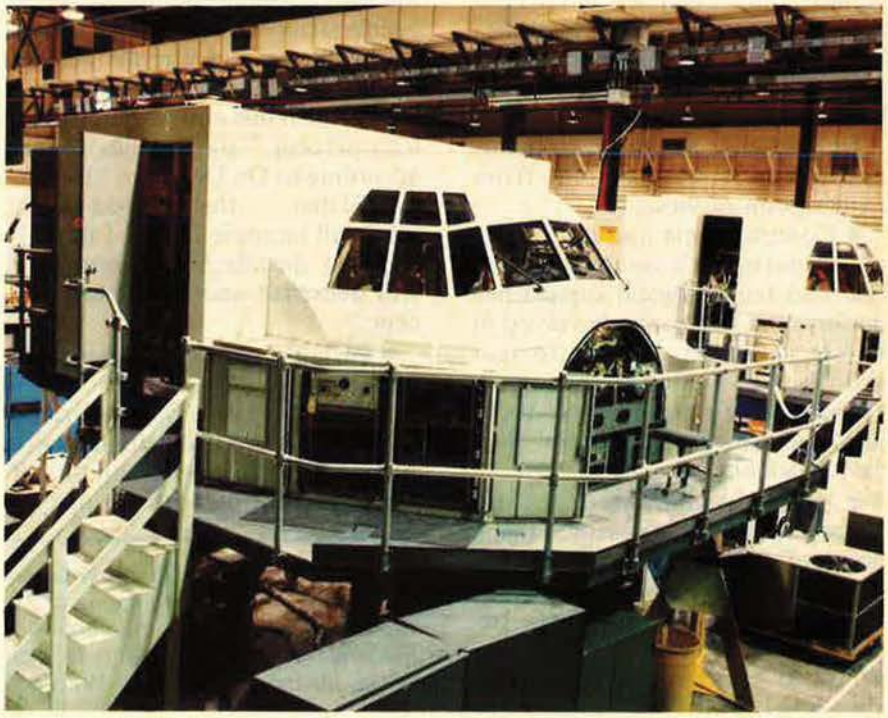
How important is IR&D to the private sector and to the military? Dr. Richard D. DeLauer, Under Secretary of Defense for Research and Engineering, told Congress last year that he considered a proposal to change the IR&D funding and reimbursement rules "the most important issue currently before us."

Except for certain procedural improvements already in effect, Dr. DeLauer did not want the system changed. He likes the results the Pentagon is getting from the current system and did not want to see the system tampered with. (The proposal was finally scrapped, thanks, it is reported, to some attentive listening and after-hours homework done by some of the more senior members of the House Defense Appropriations Subcommittee, which was holding the IR&D hearings.)

### A View from Industry

Dr. DeLauer's evaluation was echoed in the testimony of numerous industry witnesses who also testified on the proposed changes. Among the more knowledgeable and more persuasive witnesses was Allen E. Puckett, Chairman and CEO of Hughes Aircraft, who appeared before the subcommittee as the collective spokesman for four of the principal associations concerned with the military/industry interface: the Aerospace Industries Association, the Electronic Industries Association, the National Security Industrial Association, and the American Electronics Association. He addressed a number of matters related to the IR&D program as now monitored by DoD, among them the following:

- The fallout benefits for national security. "Almost none of the dramatic new technologies of this century was conceived as a result of the statement of a military requirement, or the specifications in a Defense Department contract. Consider, for example, the airplane, radar, jet engines, rocket engines, semiconductors, lasers, microcircuits, communications satellites, and, of course, nuclear weapons. The conception and initial exploration of these ideas were carried out by members of our engineering and scientific community . . . working in an environment which allowed and stimulated novel and unorthodox thinking."
- The legal and practical limits to reimbursement. Mr. Puckett was apparently troubled by occasional charges that any IR&D reimbursement by DoD or other agencies amounts to a "giveaway" to private industry. In practice, the Defense Department will recognize "some fraction of the IR&D account as 'allowable' " in determining the overhead rate applicable to a specific contract. The ceilings negotiated, however, "are invariably less than the total IR&D expense which the contractor will incur—typically seventy to eighty percent of the contractor's proposed expenditure." That seventy to eighty percent ceiling, moreover, "is almost always less than the contractor actually spends. Statistics show that industry ceilings average about seventy-five percent of the actual costs." The bottom line, after the government's cost-accounting rules are factored in and according to "DoD's own statistics," is that only about forty-two percent "of the IR&D subject to ceilings established through negotiated advance agreements were allocable to DoD contracts."
- The very real control that, despite the "independence" factor, the Defense Department exercises over IR&D. The Department conducts, to begin with, "an annual determination of potential military relevance for each IR&D project at the beginning of the company's fiscal year." It also conducts "an annual after-the-fact" review of each IR&D project "to ensure that the required level of potential military relationship has been maintained." Finally, DoD evaluators "provide



***Prime examples of military systems resulting from IR&D are Boeing E-4B/747 aircraft (left), General Electric F101 DFE engine, now the F110 engine (above), and Link C-130 simulators (right).***

written comments on individual projects, suggesting revised technical directions and commenting in general on the value of the IR&D project to the DoD." Those comments are returned to the company, "where they become an important input to the company's internal review of IR&D." Mr. Puckett emphasized that the various DoD reviews and evaluations, although not necessarily binding on the companies in a legal sense, nevertheless "have teeth in them, since the results directly impact IR&D dollar ceilings for cost recovery."

### The IR&D Bonus

Dr. DeLauer, the Administration's point man during the IR&D hearings, also discussed dollar ceilings, explaining that the partial cost recovery sometimes allowed by DoD for IR&D pays off in ways not always understood by the Office of Management and Budget (OMB) and congressional watchdogs of the public purse.

"The latest Defense Contract Audit Agency report," Dr. DeLauer noted, "lists, for 1982, $3.2 billion of IR&D conducted by industry. The DoD share of this cost is about $1.2 billion. Using a conservative estimate of ninety percent of industry's effort having a potential military relationship, we have gained the benefit of $1.7 billion of DoD-related technical effort which we reviewed and influenced but whose costs were absorbed elsewhere. . . . Under the present IR&D system, DoD has very high leverage for its funding."

Dr. DeLauer added a few bonus points for IR&D—which, from DoD's point of view:

- Complements and multiplies the Department's in-house scientific and technological capabilities because the companies involved in IR&D invariably assign to it—strictly for business reasons—"some of the most creative technical and management people" they have available.
- Virtually guarantees (again, strictly for business reasons) that a program's costs will not spiral out of control—even without micromanagement by government—because a free market forces companies to "keep costs at a reasonable level. . . . The marketplace dictates reasonableness" and requires that "constant management surveillance" be exercised "to ensure that limited funds are used in the most productive way."
- Makes it possible to exploit "surge" and "breakthrough" opportunities immediately and carry them through to their maximum potential. Company programs, unlike government-funded and -controlled RDT&E projects, are generally freer of red tape and unencumbered by the heavy hand of regulation. "The ability of a contractor to terminate or modify IR&D projects [is] a major strength of the current process. A company can and does respond quickly to changing DoD needs and can take advantage of windows of opportunity."

### Fallout Benefits

Warming to his subject, the Under Secretary of Defense for R&E elaborated in considerable detail on the IR&D "fallout benefits" for defense alluded to earlier by Mr. Puckett. Among the numerous examples of "important advances" and "recent accomplishments" made possible through the IR&D process, said Dr. DeLauer, are the following:

- Aircraft engine improvements. "By integrating several technologies, including lightweight dynamics/structures, high-temperature coatings, fan aerodynamics, and airfoil materials and cooling, there has been a steady increase in the thrust-to-weight ratio of aircraft engines from 6:1 to 8:1 and a concomitant reduction in fuel consumption of fifteen percent." By 1990, moreover, according to Dr. DeLauer, "It is expected that . . . the thrust-to-weight ratio will increase from 8:1 to 10:1, and that specific fuel consumption will decrease another fifteen percent."
- Portable secure military communications. "Modification of a non-DoD portable two-way radio transceiver allowed military procurement of units for ground-to-air communications with no direct-funded R&D. Subsequently, five different models were developed under IR&D initiatives." Some of the models "allow secure military satellite links through a hand-held, collapsible antenna that can be transported in the field by a single person. This capability is the first to provide reliable worldwide communications to an individual field soldier. . . . [It] also can be used for line-of-sight vehicular and aircraft communications."
- Manned multiple-aircraft air combat simulators. These include a facility that "allows up to twelve pilots to fly simultaneously in a simulated air combat mission, in any friend-foe combination desired."
- Lasers. "IR&D has provided much of the basic technology used in the evolution of laser devices with increasing power and efficiency. The world's first laser, the ruby laser, was conceived and demonstrated under IR&D funding."

Dr. DeLauer mentioned a number of other IR&D-related innovations ranging from advanced composites to submarine navigation systems that have moved the US hardware inventory forward in recent years, and suggested that his own list of IR&D innovations could be expanded ad infinitum. He did not mention, for example, the long list of medicines and medical techniques developed in the private sector but used extensively by the military, nor any of the food-preservation and food-processing developments and techniques that in times past gave so many American servicemen and women their first unforgettable taste of Spam, powdered eggs, and similar delicacies.

### Fiber Optics and RO/ROs

Also unmentioned were two IR&D developments—fiber optics and roll-on/roll-off ships—worth looking at in more detail both because of their obvious military utility and because of the light they shed on the IR&D process.

Fiber optics shifted from theory to practical application when Corn-

---

*James D. Hessman is Editor in Chief of* Sea Power *Magazine, the official publication of the Navy League of the United States. A 1954 graduate of Holy Cross College, he served on active duty in the Navy for eleven years. Mr. Hessman worked on the editorial staff of* Armed Forces Journal *for six years before joining* Sea Power *in 1972. His most recent article for this magazine was "Sea Power and the Central Front," July '83 issue.*

ing Glass Works perfected a process in 1970 to make glass of unprecedented clarity and purity. Corning followed up by creating other processes that can produce the glass in the form of tiny, flexible, hairlike threads through which light waves can travel with virtually no distortion. The glass is so pure that, if it were possible to form it into a solid block thirty-five miles long, a person standing at one end could clearly see an object held at the other end. Most glass is clouded by so many flaws and contaminants that it's impossible to see through more than a few feet of it.

The importance of the clarity of this glass, from the military's point of view, is its usefulness for fiber optics. The cost and weight reductions and the quantum jump in communications capabilities made possible through fiber optics are impressive. Copper cable of equivalent fiber-optics capacity weighs 100 times as much. Copper, of course, is much more expensive and in shorter supply than sand, of which one teaspoonful is sufficient raw material to make an optical fiber one mile long. As for capability, "one thin light beam" transmitted through fiber-optics cable, according to *United Technologies* Magazine, "theoretically could handle all the telephone, radio, and TV transmissions in North America simultaneously."

All things considered, it is not overly surprising that all of the US armed forces are taking a long look at, and through, fiber optics, and that Corning Glass and other companies with fiber-optics capabilities have been investing heavily in fiber-optics IR&D.

Shifting from the sand to the sea, from high-tech to very definitely low-tech, and from future potential to present performance brings one to what is the most underpublicized but at the same time probably the most urgent line item in the US Navy's current shipbuilding program: conversion of eight high-speed merchant ships from their original container ship configuration into more militarily useful roll-on/roll-off (RO/RO) vessels.

The eight former SL-7s, purchased from the Sea-Land Corp., are capable of thirty-three knots (about thirty-eight statute miles per hour), fast enough to change the "Rapid" in "Rapid Deployment Force" from rhetoric to reality. They're collectively big enough at 55,875 long tons maximum-load displacement to haul—on a four-day run from the US east coast to Bremerhaven, for example—considerably more cargo than could be airlifted in the same time period by all of USAF's airlift assets put together, and at considerably lower cost. They have enough range (12,200 miles without refueling) to voyage nonstop from US ports of embarkation to crisis areas virtually anywhere in the world. And after their conversions are completed, they'll be able to carry a varied mix of outsize and heavy-lift cargo ranging from 332 helicopters and 400 vehicles in one typical loadout option to 183 tanks and 300 to 400 other vehicles in another—*per ship.*

Four of the born-again RO/ROs, redesignated T-AKRs and classified as "fast logistics ships," are to be delivered later this year—three this summer. The others will be delivered between October 1985 and March 1986. Their arrival in the active inventory will by no means solve the Navy's staggering sealift problems, but they will give the nation's decision-makers a rapid response capability never before possible and matched by no other nation in the world.

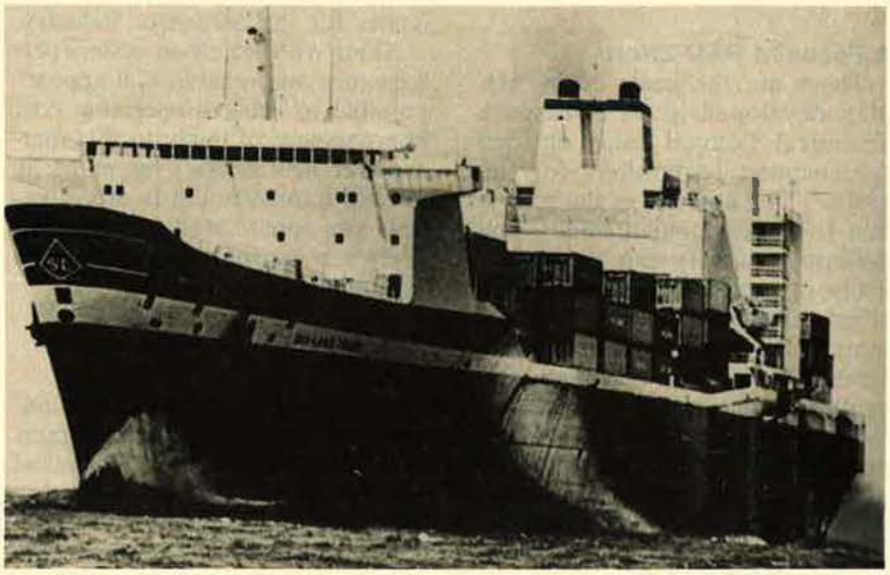
From an IR&D viewpoint, the most relevant point about the RO/ROs is that no IR&D "cost recovery" funds are involved, demonstrating anew Dr. DeLauer's point about the value to DoD of having "access to industry's complete IR&D effort."

### The Extra Mile

That complete IR&D effort, it's pleasant to report, shows no sign of abating. The Grumman Corp., to cite but one of many recent examples, announced earlier this year that it is increasing its 1984 research and development expenditures to $70 million, "virtually double" the company's 1983 R&D spending. "We're willing to put our money on the line and go the extra mile," said Grumman Chairman John C. Bierwirth, pointing out that "the edge" the company is likely to have "in future competitions . . . is certainly worth the investment in research and development."

Grumman is the microcosm. The macrocosm is reflected in a forecast by the Columbus Division of the Battelle Memorial Institute, which projects that overall expenditures "in calendar year 1984 for research and development (R&D) in the United States are expected to reach $94.2 billion." Included in that total, says Battelle, is $48.8 billion in "industrial funding," expected to be "up 10.3 percent from 1983."

Who knows? Among the literally thousands of private-sector entrepreneurs out there spending all that IR&D money may be a couple of bright lads who own their own bicycle shop. ■



***Prior IR&D funding enabled the Navy to configure civilian container ships, such as this Sea-Land Corp. SL-7, as roll-on/roll-off "fast logistics ships."***

# Industry's Plan for R&D

Focused technology development could strengthen defense at home and also improve the US position in world trade.

**BY KENNETH F. HOLTBY AND JAMES N. KREBS**

THE United States is facing challenges of unprecedented dimension on two fronts—international trade and national defense. In aerospace trade, the US still holds a technological lead, but its market share is declining due to the improved technical competence of foreign competitors, their increasing application of technology resources to aerospace products, and a variety of trade-enhancing support measures provided them by their governments. In the defense field, the US faces a Soviet Union similarly expanding its technological capability and also enjoying the advantage of greater commitment to military expenditures than is practicable in a free society.

How can the US best meet these challenges? The prime opportunity, in the opinion of the Aerospace Technical Council of the Aerospace Industries Association (AIA), lies in bold and innovative technology thrusts to create advanced aerospace products that would simultaneously reverse the trade trend and significantly strengthen the US defense posture.

Such efforts could bring to the international marketplace US products of such clear-cut superiority that their technical and economic excellence would outweigh any nontechnical marketing attractions offered by foreign competitors. Similarly, they could expand the US defense capability per dollar expended through development of military systems with greatly increased performance, reliability, and cost-effectiveness.

## A Focused R&D Effort

These are the goals of an AIA plan developed in an Aerospace Technical Council study entitled "Aerospace Technology for the 1990s." The essence of the plan is that US trade competitiveness and defense capability can be dramatically upgraded through an intensified and *focused* research and systems technology effort aimed at the 1990s. By focused we mean concentration on certain technologies that offer potential for dramatic improvements in the cost and performance of future aerospace products. When combined and integrated into new systems, these technologies promise the greatest payoffs to our trade and defense postures.

The study, which involved several months of effort by a group of aerospace industry experts, identified specific technologies that offer exceptional payoff in six major categories of aerospace systems—transport aircraft, fighter aircraft, unmanned aircraft, rotorcraft, satellites, and tactical command control communications and intelligence ($C^3I$).

The choice of categories was arbitrary; not included in the study were such other important systems as strategic and tactical missiles, carrier fleets, defensive aircraft, space launch systems, rocket propulsion, and commuter aircraft and business jets. However, the cost/performance gains estimated for the systems that were selected are indicative of the types of benefits that would accrue over a wider spectrum through the focused development and exploitation of aerospace technology for the 1990s.

A focused R&D effort, as opposed to "business as usual," can effect a dramatic upturn in the US technology progress curve and provide vast improvements over systems of the 1980s. The focused effort includes, in addition to performance-enhancing technologies for individual systems, concentration on cost superiority through emphasis on designing to cost, advanced manufacturing technology, more productive "factories of the future," and a better motivated work force—all management challenges for the aerospace industry.

Along with increased system performance and reliability, it appears possible to achieve operating cost improvement of thirty to fifty percent for new aircraft, as much as tenfold improvement in effectiveness for some satellites, and entirely new capabilities in such fields as unmanned aircraft and $C^3I$.

## Expectations for Subsonic Aircraft

By way of amplification, let's consider some of the specific programs studied by the Aerospace Technical Council group. First, we looked at technology candidates for the subsonic aircraft world market—the

largest aerospace market, whose value during the 1990s is estimated at more than $200 billion (1983 dollars), including both the military and commercial segments. This enormous market embraces all commercial transport categories from business jets and commuter aircraft to intercontinental jetliners, plus all military and strategic airlifters, tankers, and land-based and carrier-based antisubmarine warfare aircraft. In the 1990s, this market may also include long-endurance aircraft and Stealth aircraft for various missions, in addition to advanced successors of currently operational aircraft.

We selected two examples representative of this market: a long-range airlifter for either military or commercial service, and a short-haul transport.

The technologies selected for focused R&D are more or less the same for both aircraft. To cite a few examples, they include computational fluid dynamics, a design tool for studying complex airflows and airfoils by means of highly advanced computer systems; laminar flow technology, or smoothing airflow for dramatic increase in the lift-to-drag ratio; expanded use of composite materials and advanced metal alloys for reductions in weight, fabrication cost, and maintenance cost; propulsion systems, including advanced turbofans and nacelles and high-speed turboprops; advanced avionics, such as very-large-scale/very-high-speed integrated circuits (VLSI/VHSIC) and fiber-optic links; active controls (fly-by-wire and fly-by-light); and automatic energy management. When combined and integrated into new systems, these and other technologies offer sharp reductions in fuel consumption and operating costs, increased productivity, and a number of other advantages.

In the case of the long-range airlifter, the combined/integrated benefits indicated by our study include a productivity gain of 80,000 ton-miles a day, an increase of thirty percent over today's aircraft; a fifty percent increase in payload/range; a thirty percent reduction in life-cycle cost; and, in the case of the military airlifter, reduced need for tanker support. The bottom line is this: $9 billion less for a fleet of 100 aircraft over a twenty-year operating span.

For the short-haul transport, the principal combined/integrated benefit is a sixty-five percent reduction in fuel burn, a matter of special importance because this category of aircraft accounts for by far the largest portion of aviation fuel use. Lower fuel consumption, along with other improvements, could result in a forty-three percent reduction in direct operating costs, or $3 million per year per aircraft. Other benefits include increased airport compatibility and reduced air traffic control delays that would help to offset the growing trend toward airport and airway congestion.

Because there is less emphasis in short-haul operations on cruise speed and airplane size, the short-haul transport seems a good candidate for application of the high-speed turboprop. This category of

## Potential for Payoff

Here's how various technologies with potential for high payoff might apply to manned aircraft.

| | Long-range airlifter | Large commercial transport | Intratheater airlifter | Short-haul transport | Air superiority fighter |
|---|---|---|---|---|---|
| **Aerodynamics** | | | | | |
| • Computational fluid dynamics | X | X | X | X | X |
| • Partial laminar flow | X | X | | X | |
| • Shaping for stealth | | | | | X |
| • Adaptive wing contouring | | | | | X |
| • Vortex control | | | X | | X |
| • Conformal weapons carriage | | | | | |
| **Structures and Materials** | | | | | |
| • Composites and new metal alloys | X | X | X | X | X |
| • Propulsion component materials | X | X | X | X | X |
| • Automated manufacturing techniques | X | X | X | X | X |
| • Combat-tolerant structure | X | | X | | X |
| • Radar-absorbing structures and materials | X | | X | | X |
| **Propulsion** | | | | | |
| • Advanced turbofans and nacelles | X | X | X | X | |
| • High-speed turboprops | | | X | X | |
| • Engine-airframe integration for stealth (low observables) and powered lift | | | | | X |
| **Avionics** | | | | | |
| • Integrated, modular VLSI/VHSIC system | X | X | X | X | X |
| • Fiber-optic data buses | X | X | X | X | X |
| • Advanced cockpit navigation and communication | X | X | X | X | X |
| • Integrated display and control architecture | | | X | | |
| • Active countermeasures | X | | X | | X |
| • Passive electronic warfare systems | | | | | X |
| • Low radar cross section sensors | | | | | X |
| • Airport ground systems: microwave landing and wind shear detection | | X | | X | |
| **Flight Controls** | | | | | |
| • Active controls for load alleviation, stability augmentation, fly by wire, fly by light | X | X | X | X | |
| • Automatic energy management | X | X | X | X | |
| • Integrated flight and engine controls | | | | | X |
| **Subsystems** | | | | | |
| • All-electric environmental control systems and flight controls | X | X | X | X | X |
| • Advanced power distribution | X | X | X | X | X |
| • Closed-loop environmental control systems | | | | | X |
| • Advanced escape systems | | | | | X |

**Advanced technology could give fighters a big jump in effectiveness while cutting life-cycle costs by twenty-five percent.**

aircraft is an excellent target for focused technology because today's short-haul transports are not well adapted to the needs and pressures anticipated in the 1990s.

### Advanced Air-Superiority Fighter

Another category studied was the advanced air-superiority fighter. The US has long relied on superior quality to offset the Soviet advantage in numbers, but growing evidence indicates that the Soviets are upgrading their fighter forces with greatly improved quality. Thus, to maintain its qualitative edge, the US must develop a new air-superiority fighter.

Aerodynamics and materials and structures technologies offer lighter, more survivable airframes that can operate efficiently in the supersonic flight regime. Advanced vehicle subsystem technologies have potential for reducing weight and volume as well as increasing survivability and supportability. Secure communication and navigation development can provide integrated communication, navigation, and identification capabilities and effect significant force multiplication. Propulsion technologies offer gains in survivability together with improvement in performance and reliability. In short, successful development and integration of these technologies promise an aircraft for the 1990s with performance characteristics well beyond those of current and derivative fighters at a cost that will permit procurement in substantial numbers.

The specific technologies envisioned for the advanced air-superiority fighter include those identified earlier for subsonic aircraft, plus a number of others, such as Stealth shaping to get a very low radar cross section, adaptive wing contouring for a major gain in supersonic lift-to-drag ratio, damage-tolerant structures, passive electronic sensors, and active countermeasures.

Integration of more than twenty advanced technologies could provide a twenty-to-one improvement in mission effectiveness compared with today's most advanced operational fighters due to greatly increased survivability, two-to-one improved availability, and a twenty-five percent reduction in life-cycle cost. The price tag for a fleet of 1,000 such aircraft over twenty years of operation would be $14 billion less than for a fleet not embodying these advanced technologies.

### Tactical $C^3$

The area of tactical $C^3$ systems obviously demands focus on a somewhat different group of technologies from those mentioned earlier. Generally speaking, the focus here is on advanced electronic devices, sensors, information-processing systems, and communications. Among the individual benefits identified are a hundredfold increase in processing speeds; tactical imagery of higher resolution, delivered directly to the user in all weather; improved survivability and reliability; and lower cost. Collectively, advanced $C^3$ technologies can enable the tactical command structure to function with a degree of efficiency and effectiveness never before achieved, to manage information at unprecedented speed, and to quicken dramatically the response to enemy counterthrusts.

These examples provide some indication of the immense benefits that could accrue to the United States through a focused R&D effort. It boils down to this: The combination of greater system capability and sharply reduced costs would greatly enhance US competitiveness in both the military and commercial areas. US product superiority could be reestablished where it has eroded, expanded where it still exists.

Clearly, attainment of these goals demands better long-range planning together with increased funding for technology development by both industry and government. It also requires enlightened R&D and export policies supported by long-term priorities.

If such a strategy is adopted, sustained, and vigorously supported by accelerated investment in computer-aided engineering, computer-aided design, and computer-integrated manufacturing, and is backed by progressive management of the work force for increased productivity and cost superiority, then the United States can simultaneously effect a stronger defense capability and a position of clear-cut product superiority in international aerospace trade.

This goal is technically feasible and is one whose broad potential benefits fully justify the requisite support and investment. ■

*Kenneth F. Holtby is Senior Vice President at The Boeing Co. During his thirty-seven years with Boeing he has held numerous senior management positions, including Vice President of new programs for Boeing Commercial Airplane Co. James N. Krebs has been Vice President and General Manager of General Electric Co.'s Military and Small Commercial Engine Operations since 1978. During his thirty-three years with GE, he has held various design and development engineering assignments. Mr. Holtby and Mr. Krebs are co-chairmen of the Aerospace Industries Association Technical Council study on Aerospace Technology for the 1990s.*


# Upgrade all your long-range HF radio communications with the one system that's Pacer Bounce approved.

Transceiver shown with multi-voltage power supply.
NSN 5820-01-162-3400

It's not hard to see why the new Harris RF-350 High-Performance HF Transceiver Group is the one system selected for the U.S. Air Force's Pacer Bounce HF radio program. It's the forerunner in today's new wave of high-performance microprocessor-controlled transceivers.

**Flexibility to meet any application.**
Whatever your application—fixed station, transportable, tactical or mobile—count on the RF-350 Group to provide reliable long-range HF voice and data communications. It delivers a full 100 watts PEP and Average (500 or 1000 watts when used with one of the Linear Power Amplifiers). It's adaptable to a wide range of international power sources. And it gives you unique advantages like built-in FSK modem, secure voice/data interface, and phone patch.

**Easy to operate and maintain.**
Operation is easy—with field programmable channelization and full remote control. Tuning is as simple as selecting a frequency and keying the unit; all other tuning functions are automatic. System self-test and automatic diagnostic BITE make it simple to identify and locate problems in the field. And modular construction puts you back on the air when seconds count.

Our full RF-350 line of nomenclatured units includes the RF-350 Transceiver; the RF-352 Remote Control; the RF-355 500 watt Linear Power Amplifier; the RF-353/354 1 KW Linear Power Amplifier; the RF-351 100/500 watt Coupler; the RF-601A 1 KW Antenna Coupler; and an assortment of accessories.

Put a world leader in communications on your side. Contact your Harris representative. Write or call: HARRIS CORPORATION, RF Communications Group, Government Marketing Department, 1680 University Avenue, Rochester, New York 14610, U.S.A. Phone: 716-244-5830. Cable: RFCOM; Rochester, New York. TELEX: 978464.

HARRIS

**For your information, our name is Harris.**

Harris can supply many of its radio products on our GSA schedule No. GS00K840150153.

See us at AFCEA, June 19-21, Booth A240.

## New High Ground: Space Communications

# We speak the language.

At Ford Aerospace, we've been involved in high ground communications for over a quarter-century. Involved successfully with the people and the systems that helped bring space communication operations down to earth.

Today, we're applying our capabilities and legacy of experience t a new space mission support challenge: The Consolidated Space Operations Center [CSOC] Communications Program. Communications for the command and control of DoD space shuttle and satellite missions and integration of military and NASA space operations.

To reinforce our commitment to CSOC Communications, we've teamed with the Harris Corporation, ORI, and CONTEL

Information Systems. Together we offer total systems capability for CSOC Communications plus collective experience in virtually every program with which CSOC interfaces. Programs like AFSCN, SPADOC, NORAD NCMC, JSC MCC, NASCOM, GPS and DMSP.

Our innovative implementation plan for CSOC Communications features a design based on system trade-offs to offer the most effective balance between advanced technology and proven USAF operations and support concepts.

Because whenever the conversation turns to CSOC and the new high ground, Ford Aerospace really communicates.

Ford

**Ford Aerospace & Communications Corporation**

# Who is the bright light in Ring Laser Gyros? Singer's Kearfott Division...naturally.

Delivery of the first development Ring Laser Gyro inertial sensor assembly for Tomahawk II was accomplished in 1983. This was in accordance with a contract awarded by the Joint Cruise Missile Project, Washington, D.C.

More than 8 years concentrated experience in RLG technology has been combined with over 30 years in the development and production of high accuracy gyros and systems to produce full-up RLG inertial navigators with more than 3 years of flight tests.

We have dedicated facilities and the resources necessary to provide assurance to current and future customers that we are capable of performing to their schedule with state-of-the-art systems and gyros.

The bright light in Ring Laser Gyros continues to be Kearfott, a division of The Singer Company....naturally.

**Kearfott**

a division of The **SINGER** Company

The Singer Company
Kearfott Division
1150 McBride Avenue
Little Falls, NJ 07424

# In Search Of an Equalizer

Technological excellence may be the best way for US aerospace exporters to offset the nontechnical advantages of foreign traders.

**BY DR. KARL G. HARR, JR.**
**PRESIDENT, AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.**

On the domestic front, the US economy is improving steadily. On the international trade scene, the picture is quite different. For more than a decade, the US has experienced a substantial and continuing decline in its trade balance, a trend that reached alarming proportions with last year's record trade deficit. That trend must be reversed—and soon—if the nation is to achieve a full and sustained economic recovery.

In aerospace and certain other high-technology areas of trade, the US is still the free world's technological leader. But the technology gap has narrowed. Additionally, the technical advantages that we do enjoy are blunted by nontechnical considerations: American manufacturers are competitively disadvantaged by foreign-government support of foreign industries. In Europe, Japan, and elsewhere, governments have adopted such supportive measures as development subsidies, tax incentives, and promotional aid and financial assistance in marketing, all of which undeniably enhance the attractiveness of our competitors' sales packages.

Thus, the US faces a two-pronged challenge from abroad: the increased technological competence of our competitors and the extra measure of competitive strength they get from government support. If we are to reverse the trade trend, our response must similarly be two-pronged. The US must develop countermeasures to neutralize, to the degree possible, foreign government support of trade. However, it is not realistic to expect that we can negotiate out of existence all of our competitors' advantages.

## The Second Prong

The best response to this challenge from abroad is the "second prong"—a bold new US technological thrust intended to reestablish product superiority where it has eroded and to expand our superiority where it still exists. In other words, we must achieve a degree of technical excellence sufficient to outweigh whatever nontechnical marketing attractions the opposition might offer.

These are the basic conclusions of a report published recently by the Aerospace Industries Association (AIA). As the principal US manufacturing exporter, the aerospace industry is well aware of the importance of exports to the industry and to the nation, and of the increasing difficulty of maintaining a strong, competitive position in world trade.

One area of difficulty, in AIA's opinion, is that the US has not been sufficiently committed to maintaining its technological leadership and fostering export expansion. To underline the vital need for such a national commitment, the AIA Board of Governors conducted a comprehensive review and assessment of critical problems facing the US in the world marketplace. The result of several months' effort on the part of the Board is a report entitled "Trade and R&D Policies—An Aerospace Industries Association Proposal." The report summarizes the problems and suggests measures essential to a revitalization of US international trade.

A prime requisite to the attainment of that goal is a strong, clear focus on the two principal factors affecting US performance in the world marketplace: trade policy and R&D policy. Many of the elements of both policies are already in place, but they are not being implemented aggressively. To be effective, trade and R&D must be mutually supportive and consistently executed, and they must have firm backing from the Administration, Congress, and the American public.

## Proposal Highlights

Here are the highlights of the AIA proposal:

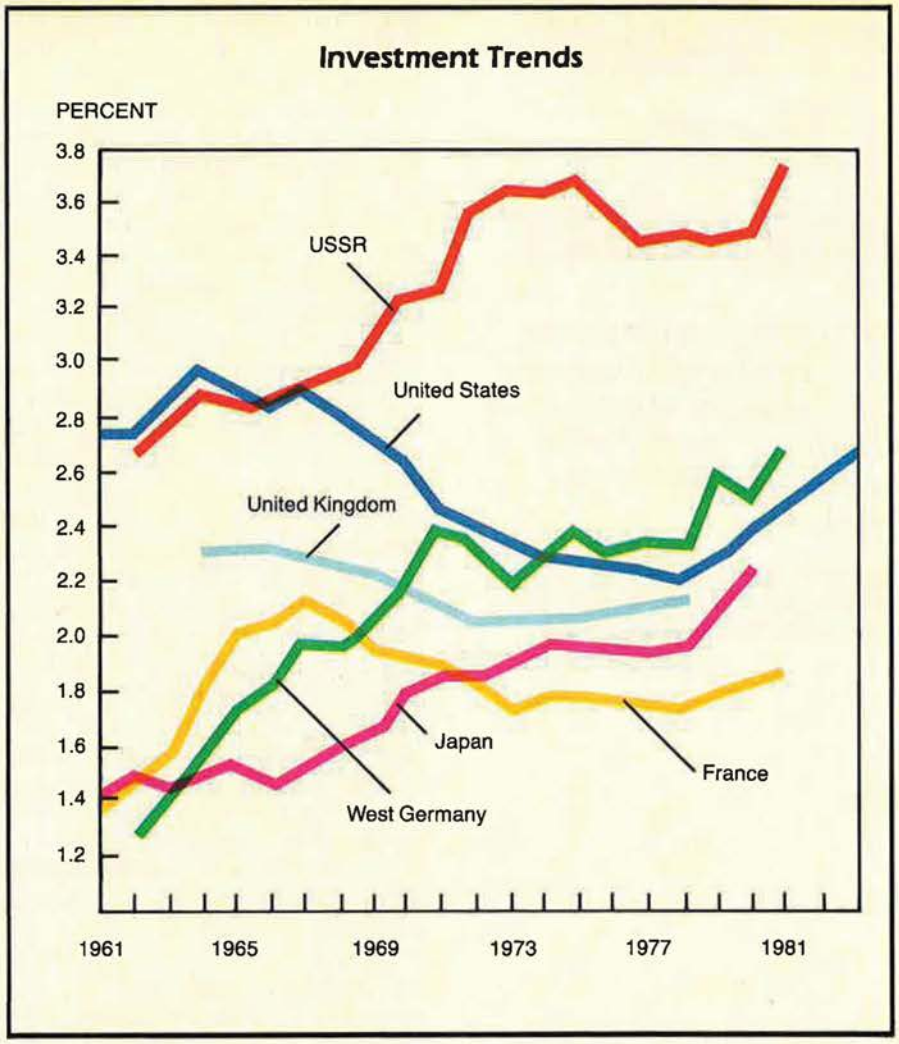
Trade and R&D policies must center on a more cooperative industry/government relationship. The government should work to create a policy environment in which industry can function effectively and competitively. An essential government contribution is strong support of fundamental research where the risk is so high and payoff so distant as to render it impracticable for industry to undertake. Industry, for its part, must review its own trade policies and practices from a perspective that accords high priority to exports. It must increase its R&D funding to expand the technology base toward development of superi-

or products and increase its capital investment to improve productivity and stimulate innovation.

An effective trade policy must assign a high national priority to export expansion, endorse fair and open trade and promote adoption of equitable rules for fair international competition, create new incentives to expand exports and eliminate existing disincentives, and reflect a view of trade as a national investment in faster growth of the Gross National Product, increased tax revenues, and higher employment levels.

Along with according higher priority to research and development, the R&D policy must encourage effective cooperation among government, industry, and the academic community; maintain the strengths of decentralized decision-making by industry; and provide effective long-term incentives toward reestablishing product superiority.

Let me amplify some of these latter points. For example, there exists under law a twenty-five percent credit for certain industrial research costs. But this credit has proved to be inadequate because it is allowed only for *increased* research expenditures above a company's historic level of outlay. In the aerospace industry, most research programs are of a long-term nature, requiring consistently high levels of funding over periods of three years or longer. Since only increased outlays qualify for the credit, there is no incentive for continued, sustained research programs with annual outlays at consistent levels. This means, simply, that many meritorious research projects may not be undertaken because they are economically impracticable without the credit. The R&D credit is scheduled to terminate at the end of 1985; it should be continued, but the law should be modified to provide a meaningful credit for continued, sustained research activity.




***The graph shows R&D as a percentage of Gross National Product.***

## R&D Policy

Another area that demands policy modification is Independent Research and Development (IR&D), a government term for that part of a company's total R&D effort that is company-initiated, company-funded, and company-directed to improve the firm's competitive position. IR&D is an overhead cost, generally recovered in the cost of products sold by the company, whether the products are government or commercial. Where the customer is a government agency—such as the Department of Defense—the government benefits from stronger competition among contractors and from broader expertise applied to future defense needs.

Unfortunately, the process for recovering costs of defense IR&D is little understood. This lack of understanding has bred criticism that has resulted in overstringent government procedures for cost recovery. Larger contractors are required to negotiate advance agreements in which IR&D costs allowable under defense contracts are limited. The industry average for recovery under DoD contracts is about forty percent of total IR&D costs; in other words, industry is forced to share the costs of research on defense systems. In the aerospace industry view, such cost-sharing should be eliminated and contractors should recover 100 percent of their IR&D expenses allocable to defense contracts, in the same manner as they recover other bona fide overhead expenses.

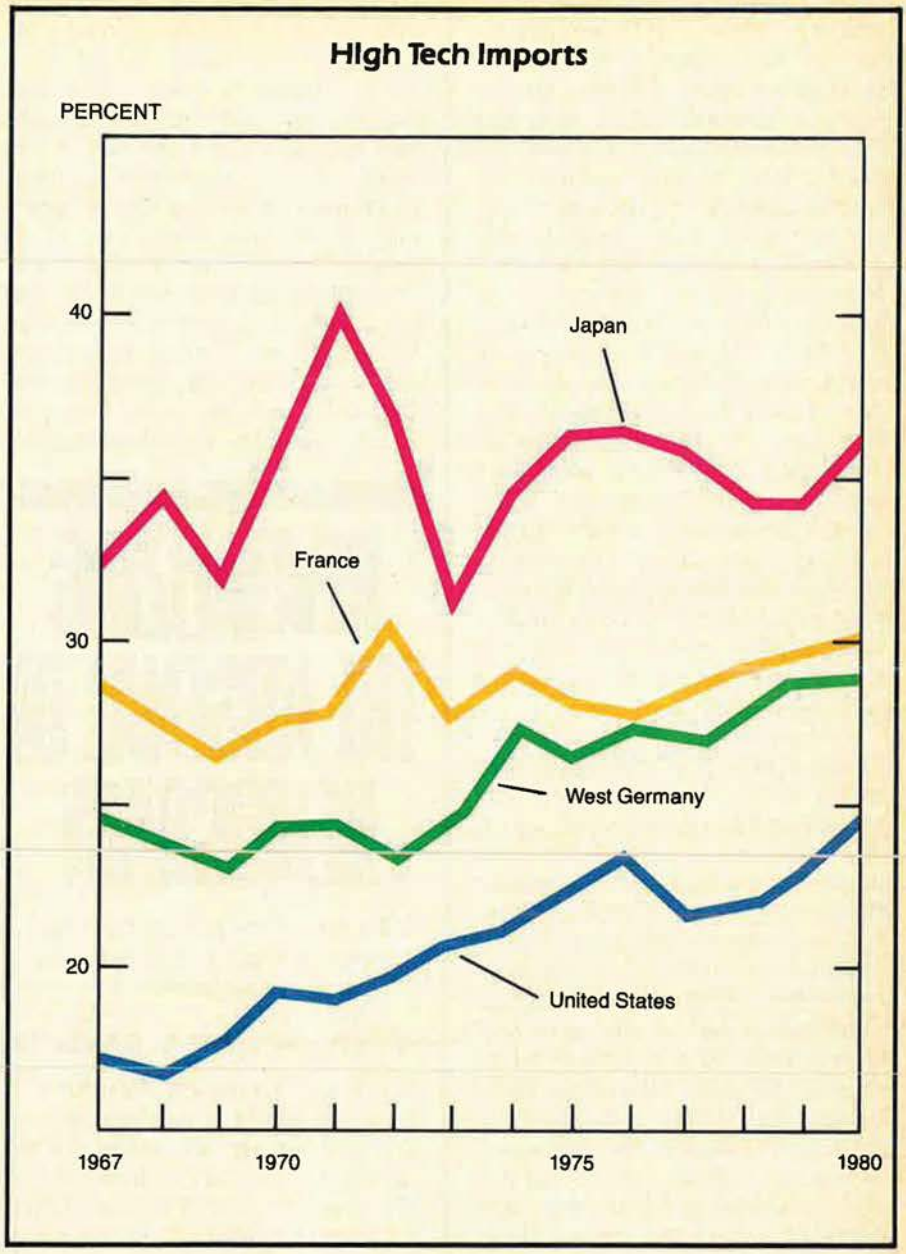
---

*Dr. Karl G. Harr, Jr., has been President of the Aerospace Industries Association since 1963. A former Special Assistant to President Eisenhower for Security Operations Coordination, he has held several high-ranking posts in both the State Department and the Department of Defense. Dr. Harr is a graduate of Yale Law School and also holds a doctorate in political science from Oxford University's Balliol College.*

A major reason for the improved competitiveness of foreign producers is the consortium arrangement, wherein companies—or countries—band together in a development and production program to share risks, pool their capital and technology, and broaden the market for the end product. In recent years US aerospace manufacturers have increasingly entered into cooperative relationships with foreign companies to gain market share and reduce risk. Some types of programs could benefit from collaboration among two or more US manufacturers, possibly with foreign participation as well. This would offer such bonuses as more US jobs, a wider selection of partners, and fewer American companies conducting duplicative research that drains limited capital and personnel resources.

But US antitrust laws discourage such ventures. Industry perceives a risk of heavy damages and criminal sanctions under these existing laws. This barrier to collaboration must be removed in order to permit American companies to compete more vigorously in various world markets.

Patent rights are a stimulus to R&D in two ways: First, they encourage investment by providing a protected market for an invention that may result from the R&D; second, a patent in one area stimulates competitive R&D through the necessity for "inventing around" it—that is, finding a different approach to product development than the one already patented. Under law, small businesses, universities, and domestic nonprofit organizations may retain title to inventions made in the performance of R&D under government contract. Such provisions should be extended to *all* contractors.




***This is how the US compares with other major industrial nations in high-technology imports.***

### The Industry/University Interface

If the aerospace industry is to expand its R&D effort, one area that demands greater attention is the availability, adequacy, and utilization of scientific and engineering manpower. There is a need to strengthen the interface between the aerospace industry and the American university system, which performs most of the nation's basic research and provides its technical manpower. Both industry and universities could benefit from expansion of industry-funded, university-conducted contractual research and other support—from research consortia to grants or loans of equipment.

However, such support is costly to industry. The government should recognize that fact and provide incentives to encourage greater industry/university collaboration. One measure that would be helpful is expansion of the twenty-five percent tax credit for industry-funded R&D to include contracted work performed by universities; currently, only sixty-five percent of contracted research or basic research grants to universities is allowable in calculating the tax credit.

These are some of the major points that the national trade and R&D policies must address if we are to revitalize our international trade posture. Of fundamental importance is that industry must be able to count on stable, continuing policies backed with a long-term commitment to their implementation. Given such national purpose, I am confident that the US can regain its lost competitive momentum and effect a reversal of the trade trend. ■

# REVITALIZING THE ARSENAL OF DEMOCRACY

Why the defense industrial base is ailing, and what might be done about it.

**BY DR. JACQUES S. GANSLER**

At the end of 1980, the House Armed Services Committee Industrial Base Panel headed by now retired Rep. Richard Ichord put out a report entitled "The Ailing Defense Industrial Base: Unready for Crisis." The report stated that "the general condition of the defense industrial base has deteriorated and is in danger of further deterioration." It pointed out that there were no ongoing programs to address industrial-base efficiency or preparedness issues. There were no plans, no procedures, no organizations, and no actions. In summarizing the report, Rep. Melvin Price (D-Ill.), Chairman of the House Armed Services Committee, stated: "In the event of a war, the US defense industry would find it almost impossible to expand its weapons production suddenly and dramatically, in the numbers necessary to sustain a prolonged conflict."

Coming from a normally pro-defense group, these were very strong words. However, they were backed up by two additional reports that appeared at almost the same time—one by the Defense Science Board, which comprises many leaders of defense industry and is chaired by Robert Fuhrman of Lockheed, and the second by a panel commissioned by Air Force Systems Command and headed by retired USAF Gen. Alton Slay. These reports had similar conclusions as to the poor health of the "arsenal of democracy." They, too, found major peacetime problems with economic efficiency and serious obstacles to rapid response in times of crisis.

Some of the specific problems that were highlighted are: lack of capital investment for productivity enhancement; lack of long-term R&D investment; lack of labor stability; inefficient use of facilities, meaning underutilization without surge capability; significant bottlenecks, especially at the lower-tier supplier base; heavy dependence on single suppliers, thus providing no competition after the initial award; and a growing dependence on foreign sources for critical defense parts and materials.

## How Did We Get Here?

Clearly, something needs to be done to improve the health of America's defense industrial base. But first we need to understand how we got into this position.

Essentially, there are three causal factors, the first being the long-standing policy that America's deterrent posture to prevent *all* forms of conflict rested on our strategic nuclear forces. The concept of "mutual assured destruction" was believed by many to be sufficient to prevent any Soviet adventurism. Second, if any conflict does occur, the "worst case" (and therefore "the one for which we should be prepared") would be a sudden attack by the Soviet Union on Western Europe that would, it was believed, either end quickly or escalate rapidly to nuclear warfare. Third, in the post-Vietnam era America shifted its budget priorities dramatically from national security to social programs. In constant dollars, the military procurement account dropped from the end of the 1960s to the middle of the 1970s from a level of $44 billion per year to $17 billion per year.

Under these "demobilization" conditions and given the emphasis on a no-warning, short, intense conflict in Central Europe, it was only natural that all available dollars were focused on buying equipment for a "come-as-you-are" war and that there was a total deemphasis of industrial preparedness actions. Over the past fifteen years, there has been little or no money spent on the industrial base. Until the current Administration, even the guidance that the Secretary of Defense gave to the military services explicitly deemphasized industrial preparedness.

But there are clear signs—from both the executive and legislative branches—of the growing recognition of the need for "revitalizing the defense industrial base." Part of this initiative comes from the realization that a restructuring of the way Defense does business is necessary to reverse the long-term trend of rising equipment costs. (This recognition has led to demand for "procurement reforms" from Congress and DoD's acquisition "initiatives" from former Deputy Secretaries Frank Carlucci and Paul Thayer.)

But there is also a growing recognition that, as the Soviet Union has achieved parity in nuclear weapons, there is a need for greater focus on conventional warfare and on the role that industrial preparedness can and should play in all four prongs of America's national security posture: deterring war (by being prepared); encouraging arms-control agreements (by covering a possible "breakout"); assuring that if war does break out it can be maintained below the nuclear threshold (by being able to support a protracted conflict); and assuring that the US will be able to achieve its national objectives in any military conflict (by maintaining our technological leadership and our flexibility to respond to a wide range of contingencies).

Thus, there is a strong and growing argument for some resources to be spent on industrial preparedness as a *complement* to the far-larger and badly needed expenditures on conventional and strategic forces. However, along with committing these resources, there is a growing recognition of the need for policy changes that will realize the needed improvements from the dollars expended both for preparedness and especially for the efficient procurement of new weapon systems.

In order to understand what appropriate actions must be taken in restructuring the US defense industrial base, it is desirable to look first at a few of the specific problem areas in more depth.

## Shortage of Critical Parts Suppliers

The first of these areas is the

growing problems at the lower tiers of the defense industry. One normally thinks of our industrial base in terms of the large prime contractors—the giants of the defense industry. However, the industry is truly a "dual economy," and it is at the lower tiers—the subcontractors and parts suppliers—that some of Defense's most critical problems have gone unrecognized.

During the post-Vietnam cutback in defense expenditures, the prime contractors were kept alive—mostly through foreign military sales—but the lower tiers rapidly left the defense industry, in many instances never to return again. Even as defense expenditures turned around and began to build in the second half of the 1970s, the lower tiers continued to shrink. This trend toward fewer and fewer lower-tier defense suppliers can be accounted for by such things as lower profit, small volume, one-year orders, cyclical demand, special military requirements, market uncertainty, excessive regulation, and extensive government paperwork. Taken together, these conditions explain why defense business appears far less attractive to the lower-tier firms than comparable civilian business.

By the end of the 1970s, it was becoming clear that significant supply problems existed in such areas as castings, forgings, electrical connectors, semiconductors, and precision bearings—items utilized by almost all weapon systems. The absence of firms interested in doing defense business at these lower tiers and the increased demand for defense goods resulted in rapidly rising prices and extremely long lead times on deliveries from the few remaining, highly specialized defense suppliers—many of whom were sole suppliers for these critical items.

As defense budgets are increased and the quantities of complete weapon systems requested goes up, the number of lower-tier suppliers does not expand correspondingly, as it would in a normal market. This phenomenon is caused by the high barriers to entry that exist for new firms that might otherwise be drawn into the defense marketplace.

In addition to the above-noted undesirable characteristics of doing business at the lower tiers of the defense industry, the unique acquisition practices of DoD discourage prime contractors from developing multiple sources for lower-tier supplies. For example, these practices frequently have the perverse impact of rewarding cost growth in the form of cost-based contracts. Prime contractors have little incentive to seek competitive supplier prices under such conditions. Moreover, prime contractors are not generally rewarded for increased efficiency, so there is a tendency to avoid the added front-end costs and administrative complications of qualifying additional—competitive—suppliers.

**The United States is the only nation in the world that does not treat its defense industry as a national resource.**

Thus, the easiest and often only option the prime contractor has is to go to the same supplier that he has used for the small quantities bought previously. These suppliers, displaying monopolistic tendencies, simply add the increased orders to their *already existing queues* and raise their prices. Both of these trends have been documented extensively over the last few years. The two or three *years* that it takes to get some of these critical parts is not due to the manufacturing time itself but rather to the fact that the current suppliers are already at full capacity operation and to the failure of the supplier market to expand.

The saturation of the few, highly specialized suppliers and the absence of capacity expansion either at these firms or through new entries cause the bottlenecks and the resultant rising costs and increasing lead times at the lower tiers. This, in turn, causes corresponding increases in costs and lead times in the vast majority of complete weapon systems. This has been amply documented over the past years.

Offshore purchasing of parts is an option being used increasingly by many defense prime contractors in solving these lower-tier problems. This naturally raises the foreign dependency issue—a historically critical one for defense procurements. Yet the trend has clearly been in the direction of a growing list of foreign suppliers of critical defense-related parts and subsystems ranging from precision glass through specialty forgings. Many of these foreign suppliers are the sole source for critical items.

In some cases, the US firm is buying its defense-related equipment offshore because it simply cannot obtain it in a reasonable time period or at all in the United States. In other cases—such as electronics components—the offshore purchases are tied to commercial demand for lower costs. DoD is simply too small a buyer to change this trend. In a growing number of cases, the offshore purchase of defense parts or subsystems is connected with an "offset agreement" for weapon system foreign military sales. Under these agreements, a foreign country buys a weapon system from the US and the selling firm in turn agrees to buy—or help sell in the US—parts and subsystems from the foreign country.

### Extra Capacity at the Prime Contractors

Interestingly, the second of the industrial base problems is the inverse of the lower-tier situation. At the prime-contractor level we frequently find considerable excess capacity—empty or underutilized plants and old and inefficient capital equipment. Naturally, if a plant is not being utilized, there is very little incentive for capital investment in modern manufacturing equipment.

Take the aircraft industry, for example. In the 1950s the United States bought more than 3,000 fighter planes per year. In the 1960s this went down to around 1,000 fighter planes per year, and in the 1970s down to around 300 fighter planes per year. Yet the structure of the aircraft industry remained largely the same, with essentially the same number of plants.

In order to pay for the high over-

head of these facilities, often containing mostly engineers writing proposals for new programs, it has been necessary to reduce the quantities and slip the schedules of those few aircraft programs in production. And the existence of these empty or underutilized plants does not even assure surge or mobilization responsiveness due to the bottlenecks in the lower tiers. In fact, today it would take *more than three years* for a warm (in-production) aircraft factory to increase its output appreciably from its low, peacetime levels in order to meet a crisis or war demand. The existence of an empty aircraft plant does not assure that you can get the needed landing gears or electronic parts that you require to increase production.

### Labor Instability

From the above discussion, it would appear that there are probably more firms and plants than are required in the military aircraft industry. Since there are only a few aircraft programs awarded every decade—and then to only one firm for each program—this means that there is bound to be a great deal of labor instability in the industry. When a new contract is awarded to a firm that has previously not had much business, the skilled labor force has to be hired and trained—only to be laid off when the contract is over.

The third problem, then, in the defense industry is the cyclical hiring and firing of thousands of defense workers. This cyclical employment pattern diminishes the efficiency that one would like from a work force. It is inefficient to hire and train workers rapidly. It is also inefficient to be laying off people because they tend to slow down considerably when the work force is being reduced. Yet no consideration of this desired work force stability is explicitly introduced into the defense acquisition decision process.

For example, the decision to build much of the B-1B in Columbus, Ohio, at a facility that has not built an aircraft in decades necessitates the creation of an enormous work force. When the 100 planes are completed, these workers will likely face a fate similar to the 17,000 workers who were laid off in Los Angeles, Calif., when the Carter Administration terminated the B-1A.

### Lack of Continuous Competition

The fourth dominant characteristic of defense industry in contrast to the civilian economy is the absence of continuous competition—*i.e.*, the market incentive to cut prices. In the defense business, there is usually fierce competition for the initial award of a new weapon system. Since all competitors know that this is the only new program coming along in this business area for perhaps five to ten years, those currently without business know they *must* win the contract if they are to stay in that business over the next decade. Additionally, since they realize that only one award will be made and that subsequent to that award there is an almost 100 percent probability that the program will change as it progresses (thus voiding the original contract), there is incredible incentive to "buy in" in order to be sure of winning the contract.

Thus, the government creates an underpriced program with a monopoly supplier. In such a situation, it is obvious why costs are likely to grow rather than shrink during the life of the program.

Clearly, all of the four major problems described above are strongly interrelated. The difficulty of doing defense business at the lower tiers (small volume, single-year buys, program uncertainty, specialized requirements, etc.) results in a disincentive for firms to enter or stay in business and, thus, in a diminishing number of lower-tier suppliers. The all-or-nothing prime contractor competitions for the award to a single supplier results in labor instability and—for the losers—excess capacity. In addition, the lack of continuous competition results in the absence of incentives for the prime contractor (once he has won an award) to make capital investments to lower his price or to create competition at the lower tiers in order to lower the suppliers' prices.

Since the Department of Defense is the sole buyer—as well as the banker (through progress payments), the regulator, the specifier, the sponsor of research and development, and even the court of claims (on protests)—the government has the *responsibility* to concern itself with the structure, conduct, and performance of the industry that it creates. Government policymakers are starting to come to this realization. However, the government has traditionally taken the position that the free market will create the necessary economic efficiency and surge capability that is desired. While this is clearly the preferred solution, it is an impossible condition to create when the market consists of a single buyer and usually a single or a few suppliers.

Under these unique market conditions, the relevant economic theory is the "theory of the second best." This theory calls for the government to gain visibility and, where appropriate, take corrective actions to create conditions of economic efficiency and surge capability. By taking actions on specific weapon acquisitions that will create conditions conducive to *natural market forces*—for example, continuous competition for a given system or critical part—the government can then step back and allow its desired objectives to be achieved through market forces rather than through regulation.

### Policies to Consider

Consider the following six example policies to improve industry per-

---

*Dr. Jacques S. Gansler is Vice President of The Analytic Sciences Corp. in Washington, D. C. A veteran of more than twenty-five years in government and industrial work, Dr. Gansler has served as Deputy Assistant Secretary of Defense and as Assistant Director of Defense for Research and Engineering and has held senior management positions with ITT, Singer, and Raytheon. In addition to his degrees in electrical engineering and political economy, he holds a doctorate in economics from American University. Dr. Gansler is the author of the acclaimed* The Defense Industry, *a study of problems affecting military production in the US.*

formance. Note that in each case the corrective action for defense would directly and explicitly address a major problem of the overall US economy.

**Strengthening the domestic industrial infrastructure.** The Defense Department must gain visibility into and, where required, get involved in maintaining R&D, production stability, and competition in such critical lower-tier sectors as parts and subsystems. The studies noted earlier indicated that there are major problems and bottlenecks in these areas. Single suppliers exist for a variety of critical parts on a significant number of weapon systems. The government, in such cases, should not select the second firm; it should simply require that there be at least two suppliers for each of these critical items.

**Improving worldwide competitiveness and reducing dependency.** The government should sponsor R&D on products that are both critical to defense and currently supplied only by foreign sources. This would promote domestic production and export competition on future generations of the equipment. Such a posture would be far better than establishing trade barriers on current military equipment, which would only lead to higher prices and have little long-term effect.

**Achieving maximum US economic gain from defense investments.** The government should encourage civilian and military production in the same plants. Currently, Defense Department policies and regulations discourage this coproduction. Joint production would reduce overhead costs through increased volume, increase technology transfer from defense R&D to the civilian economy, allow a more rapid surge of military production during a crisis by shifting workers from the production of civilian goods, and reduce the impact of cutbacks in defense spending that come from program terminations or arms-control agreements.

**Encouraging major new technological advances.** In traditional weapon systems (ships, planes, tanks, etc.), the Defense Department has been extremely successful in achieving technological advancement. However, institutions must be created and funding provided for the rapid development, production, and deployment of major new, *nontraditional* technologies and systems—the ones that promise dramatic, qualitative changes but threaten established, traditional military and industrial organizations.

**Stimulating lower prices and improved quality.** DoD should create a second source for many products where the United States depends on a single domestic supplier. Such a move would allow continuous competition to moderate prices, drive up quality, stimulate innovation, encourage capital investment, and broaden our base for mobilization. In areas with excess, old industrial capacity, the market should be allowed to force down the number of firms to a few that are modern and competitive.

**Implementing an industrial strategy.** The Defense Department must explicitly introduce industrial-base considerations into major decisions on planning, budgeting, and especially program acquisitions. Such issues as labor stability, plant capacity utilization, and modernization can formally be considered in this way. This would replace the current situation of allowing a "buy-in" or a political award to a plant that is far less efficient than others that are already modernized and underutilized.

## Restoring the "Arsenal of Democracy"

Actions such as these would serve to revitalize the defense industry through a restructuring of the industrial base, thereby creating a strengthened, competitive, free-enterprise industrial structure. Additionally, these actions would simultaneously strengthen the overall US economy while shifting the defense industry from its current "ailing industry" status into a competitive, responsive, national resource —essentially, restoring meaning to the phrase "The Arsenal of Democracy."

Interestingly, the United States is the only nation in the world that does not explicitly treat its defense industry as a vital national resource. Fortunately, the need for US government action in connection with its defense industrial base is finally starting to be recognized on both sides of the so-called military-industrial complex. Congress has been pushing for changes, such as for more continuous competition. The Department of Defense has initiated a series of industrial preparedness actions intended to improve the health of the defense industry at all tiers as well as the surge responsiveness of the industry.

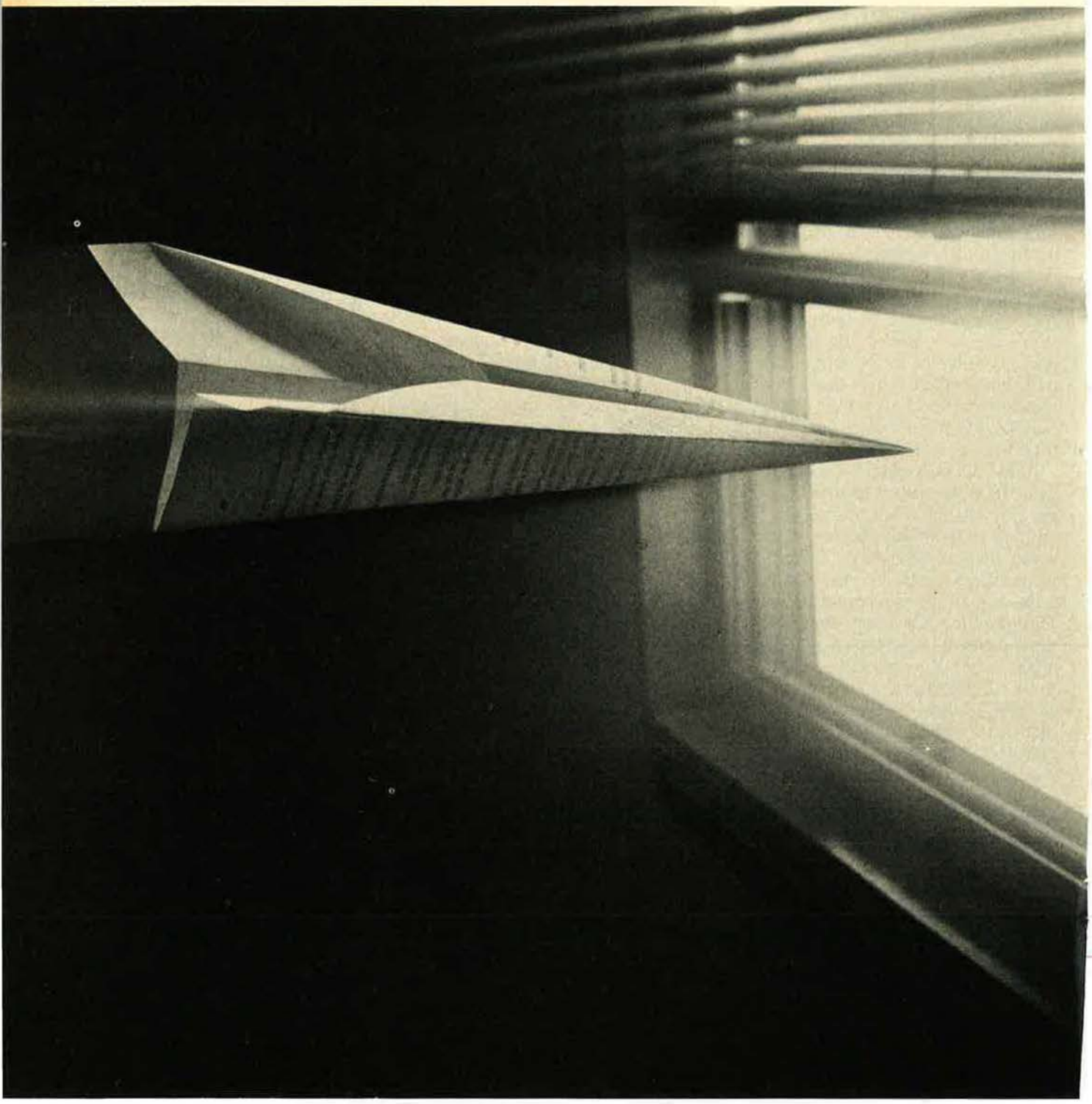
Finally, in a report of January 1984, the Aerospace Industries Association of America calls for "a new commitment and a new philosophy—characterized by a more cooperative relationship between government and industry. . . . The government must take the lead in establishing policy, with input from industry." For government to take advantage of industry's strength, "[industry] must be supported by a stable framework of policies that allow and encourage most effective utilization of the resources."

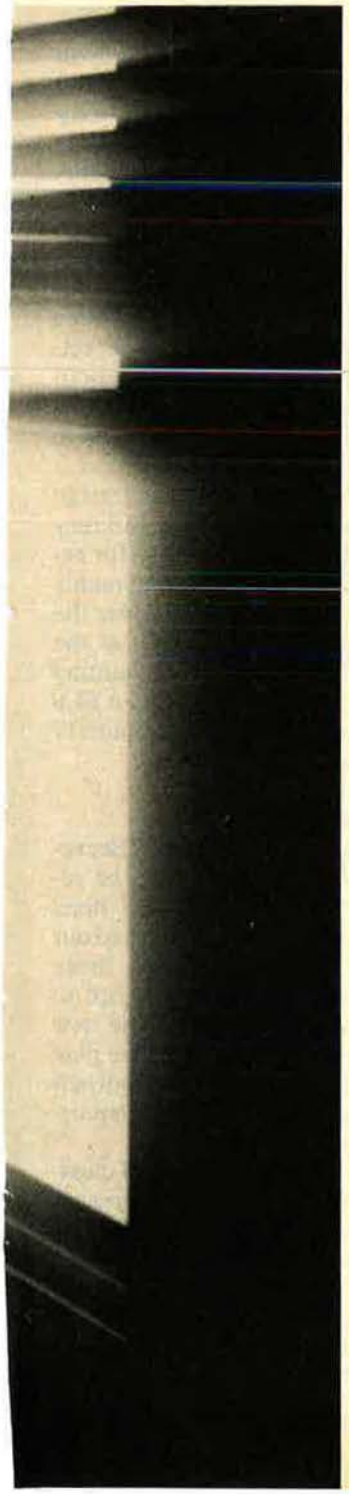
Clearly, there is much to be done before America's defense industry makes the full transformation from its "ailing industry" status to the revitalized "arsenal of democracy," but now is the time for these changes. The needed defense budget increases *must* result in corresponding increases in the amount of defense equipment supplied to our forces, and not simply in increased unit costs for the equipment. Additionally, the strategic responsiveness of our defense industry must be credibly perceived as a valuable complement to our deterrent and warfighting posture. Thus, changes in the way defense does its business are clearly required—*now.*

Some of these changes will affect the way we select our systems and the way we acquire them. These changes fit into such categories as "JCS reform," "budget reform," and "procurement reforms." But there is an additional major initiative required. That requirement is for government to gain visibility in and, where appropriate, to take corrective actions to strengthen the US defense industrial base.

None of these changes will come easily. But they must happen—our national security requires it, and the taxpayers deserve it. ■

# WITHOUT A COMPLETE Ada® SYSTEM FROM DATA GENERAL, YOU CAN TOSS YOUR DoD CONTRACTS OUT THE WINDOW.





## THE FIRST AND ONLY COMPLETE, VALIDATED Ada SYSTEM

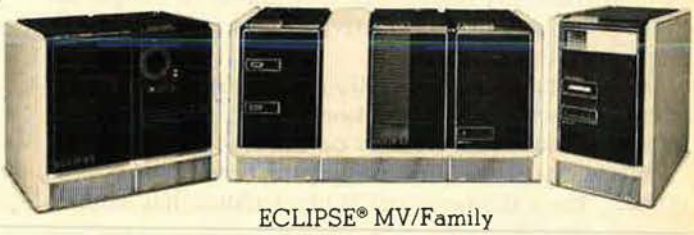
Soon, all programs entering advanced development must comply with the Department of Defense Ada Directive. There are no exceptions. So, if your company isn't fluent in Ada, it's likely your projects will have a hard time getting off the ground.

Data General is the first and only computer company to bring you a complete Ada system. It includes the first production-quality compiler validated by the DoD. Actually, that's just a small part of the story. Data General gives you a complete Ada Development Environment (ADE™), providing everything from application management tools to runtime environments, so you can start training your software engineers today.

Using ADE, you'll have capabilities for project and system management, program development and testing, as well as training support services and documentation. And, it complies with ANSI/MIL STD-1815A-1983.

## WORK ENVIRONMENTS THAT MEET YOUR NEEDS

Our Ada Work Environments are based on the industry's best price/performance series of 32-bit virtual memory computers—our ECLIPSE® MV/Family.



ECLIPSE® MV/Family

And through a unique partnership with the ROLM® Corporation, you can now get an absolutely compatible militarized target version. One that will be capable of executing our ECLIPSE MV/Family instruction set—the Mil-Spec HAWK computer.

## KEEPING YOU A GENERATION AHEAD

Data General brings you many other services for the federal market, including the UNX/VS operating system, our GW/4000™ imaging workstation, communications, a full range of software development tools and utilities, and hardware field service plans.

## THE FINAL Ada DEADLINE: JULY 1, 1984

Time is running out. If your company doesn't speak Ada by the final July 1, 1984 deadline, you could be falling behind your competition.

And since Ada is a complex language to learn, your company should start learning it now. With Data General's complete Ada Development Environment.

## UNDERSTANDING Ada

Data General will be conducting nationwide seminars on the Ada software crisis. To learn more about these seminars and more about our complete Ada system, call or write: Director of Ada Marketing, Data General Corporation, 4400 Computer Drive, MS F-134, Westboro, MA 01580, (617) 366-8911, Ext. 6183.

# Data General
# a Generation ahead.

# THE NEW FIVE-YEAR DEFENSE PLAN

The FY '85 defense budget strikes a careful balance between the needs of the forces in being and the urgency of force modernization as determined by the growing threat and changing technology.

**BY EDGAR ULSAMER, SENIOR EDITOR (POLICY & TECHNOLOGY)**

THE Administration's FY '85 defense budget request amounts to $305 billion in budget authority (BA, meaning funds that can be obligated) and to $264.4 billion in outlays, or actual expenditures. In addition, the Administration is requesting $7.8 billion in budget authority to fund defense activities carried out by the Department of Energy.

Initial congressional reaction to the request has been frosty, especially from traditional defense critics on the left and fiscal conservatives on the right.

In a telling report to the Budget Committees of both houses, the Congressional Budget Office has already termed the Administration's defense budget request a "significant challenge to Congress." Arguing that the "massive" deficit forecasts for FY '85 and beyond were based on the assumption that defense spending would be "limited to five percent real growth," the CBO report points out that this would require Congress to cut budget authority by $23.6 billion in FY '85 and by $174 billion over the next five years. The report also provided specific formulas for cutting the defense budget even deeper, including a no-real-growth bogey.

The new budget request reflects an intensive internal scrubbing that lowered the original BA figure of $322 billion by about six percent. Nevertheless, after adjustments for anticipated inflation, the slimmed-down request tops the FY '84 defense budget by thirteen percent in budget authority, and by 9.3 percent in outlays. Operating costs—in the main, pay, equipment maintenance, fuel, training, and spare parts—account for fifty-two percent of the total DoD request. Investment funding, comprising procurement, R&D, and military construction, is slated to grow by almost one-fifth over the FY '84 level. As a share of the US Gross National Product (GNP), the new budget request accounts for about 6.8 percent, significantly below such peak years as 1955 or 1968 when more than nine percent of GNP went to defense.

The defense budget request is linked to a new Five-Year Defense Plan (FYDP) that envisions a marked slowdown in BA growth in the so-called outyears (FY '86–89). That growth is expected to amount to 9.2 percent in FY '86 and then stay at just below four percent in the remaining three years of the FYDP. Total spending in budget authority over the period FY '85–89, expressed in current dollars, is forecast by the Administration at $1.8914 trillion.

The proposed FY '85 Air Force budget (BA) amounts to $108.7 billion, up by fifteen percent in real growth from last year. The Navy/Marine Corps budget is $101.3 billion, and the Army's is $77.9 billion. Active-duty military manpower is scheduled to go up by 29,900 slots to a total of 2,166,000, while the reserve components climb from the FY '84 end strength of 1,051,000 to 1,104,000 in FY '85.

USAF's active-duty FY '85 end strength is pegged at 610,000, up by 15,000 over FY '84, while the Air National Guard goes from 104,000 to 108,000 and the Air Force Reserve from 70,000 to 75,000. The number of direct-hire civilians on DoD's payroll is to be boosted by about 5,000 to an end-of-FY '85 total of 999,000. USAF's civilian personnel is to climb from 236,200 in FY '84 to 240,100 by the end of FY '85.

As mandated by the FY '84 Defense Authorization Act, the new budget includes payments to a Military Retirement Trust Fund for the accruing liability for retirement payments to the active-duty force. Payments from this trust fund to the retirees will appear under the Income Security function of the federal budget at the time the payments are made. This change in accounting procedure increases the Air Force budget by about $4.9 billion and that of the Defense Department by about $17 billion over what it otherwise would have been.

## A Prudent and Responsible Budget

In presenting the FY '85 budget to Congress, Secretary of Defense Caspar W. Weinberger termed the request prudent and responsible and said it had been arrived at by "weighing the threats and challenges to our interests, by refining our strategy for meeting those threats, and by identifying the capabilities we need to fulfill that strategy." The central objective of the new budget and the Administration's long-term defense plan is "peace with freedom," with deterrence the cornerstone of this policy, according to the Defense Department's FY '85 Annual Report to Congress.

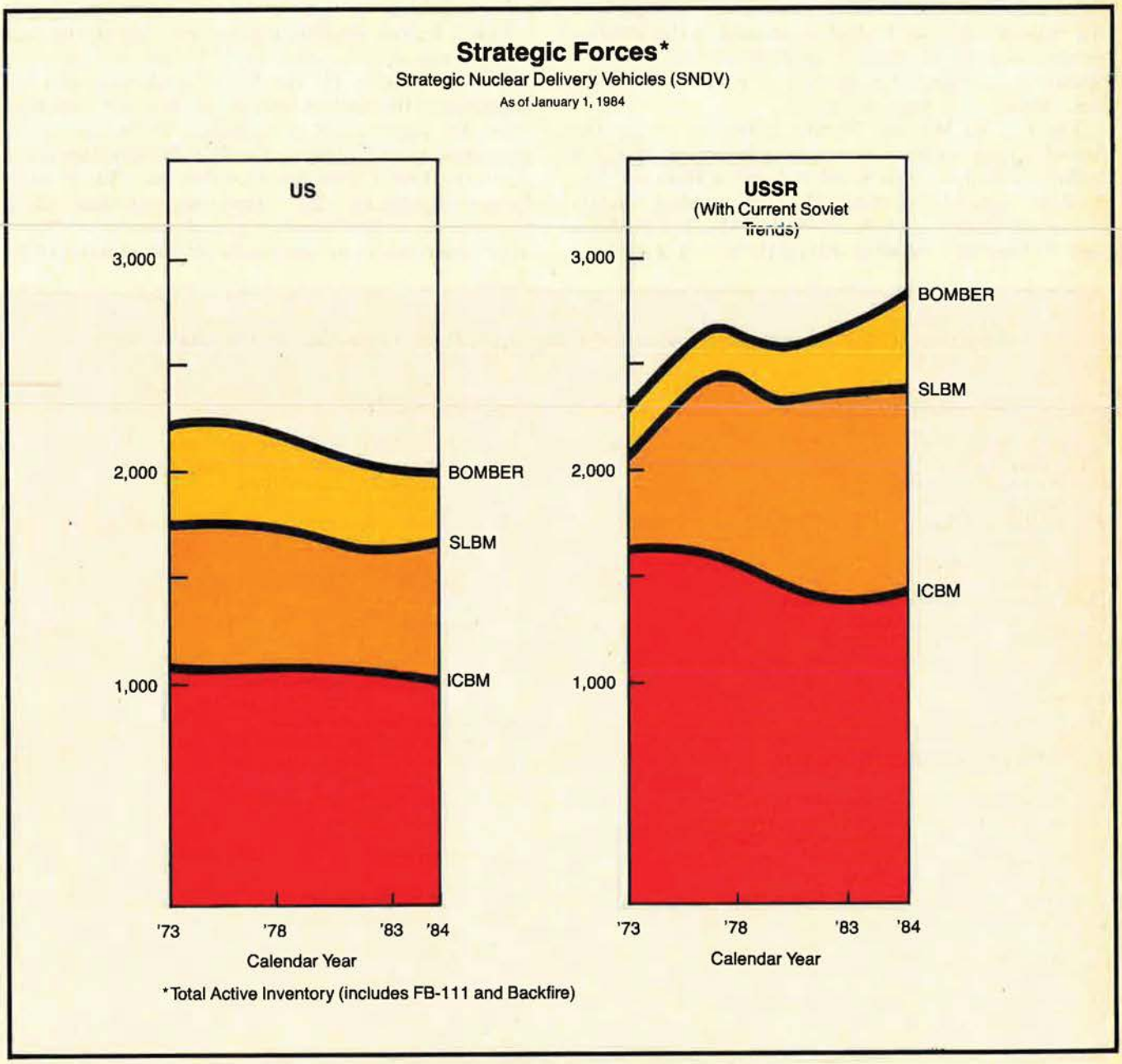
"We continue to seek nuclear and conventional capabilities sufficient to convince any potential aggressor that the costs of aggression would exceed any potential gains that he might make," Secretary Weinberger told Congress. Explaining that effective deterrence is the product of dynamic conditions—especially the perception of these conditions by a potential aggressor—he said that "unfortunately we face an adversary whose

leaders have, through their writings, force deployments, and exercises, given clear indications they believe that, under certain circumstances, war with the United States—even nuclear war—may be fought and won." The FY '85 Military Posture report by the Joint Chiefs of Staff warns that the Soviets, by having gained "advantages in certain measures of nuclear strength," are challenging the US policy of deterrence.

The US position continues to be that "nuclear war cannot be won, and must not be fought." At the same time, however, US deterrence strategy pivots in a nuclear- as well as conventional-warfare sense on the cardinal "capability, in case deterrence fails, to halt any attack and restore the peace on terms favorable to us and our allies." This capability, in turn, presupposes the availability of means to limit the scope, duration, and intensity of conflict.

Given the Soviet Union's ability to fight in more than one theater simultaneously, the US objective of conflict containment must be supported by enhanced mobility. The new budget provides for continued growth in this regard. At the same time, there is the recognition that—in order to limit the duration of conflicts—the US must demonstrate to potential adversaries "that nothing could be gained by trying to outlast us in a conventional war." To this end, the new budget request emphasizes sustainability and beefs up the defense industrial base to permit production surges.

Lastly, as Secretary Weinberger told Congress, limiting the intensity of conflict requires that the US maintain the capability to halt an attack and restore peace without resorting to conflict escalation: "Since the Soviet-bloc forces would probably enjoy numerical superiority in most theaters in which they might launch a conventional attack, we must be able to offset that advantage with qualitatively superior conventional forces." Acknowledging that maintaining this kind of technological edge doesn't come cheaply, he warned Congress that the



alternatives are either greatly expanded military forces or intensified reliance on the early use of nuclear weapons.

The Joint Chiefs' Posture statement translated these general objectives into specific military requirements, such as modernization of the strategic nuclear forces, strong alliances, forward deployed forces, central reserves, force mobility, freedom of the seas and space, and survivable command control communications and intelligence ($C^3I$) capabilities.

### The Strategic Requirements

Overarching all the components of US strategy is the need for "modern, ready strategic forces in sufficient numbers to make it clear to the Soviets that their war objectives cannot be achieved if they resort to strategic nuclear war," Gen. John W. Vessey, Jr., Chairman of the Joint Chiefs of Staff, told the Senate Armed Services Committee at the outset of this year's budget hearings. Counting relevant research and development as well as Department of Energy programs, about one-eighth of the national security budget is devoted to the maintenance and modernization of the strategic forces. Soviet spending on strategic forces over the past few years has been about twice that of the US.

The FY '85 Military Posture statement credits the Soviet Union with an operational inventory of 2,379 ballistic missiles—comprised of 1,398 ICBMs and 981 SLBMs—and 375 bombers. The comparable US totals are, as of January 1, 1984, 1,040 ICBMs, 592 SLBMs, and 325 bombers. Some seventy-five percent of all Soviet warheads on strategic weapons are on systems less than five years old while more than seventy-five percent of the US warheads are on weapons that are older than fifteen years. Continuation of present trends will give the Soviets a three-to-one advantage over the US strategic forces in time-urgent hard-target kill capability by 1987, according to the Joint Chiefs of Staff.

While the number of warheads carried by the ballistic missile forces of the two countries is roughly equal numerically—about 7,500 for each side—the three-to-one throw-weight advantage of the Soviet ICBM force enables the USSR to "destroy most of our ICBM force in its silos," according to Secretary Weinberger. In an operational sense, however, the Soviet advantage is even greater since this accounting makes no allowance for the fact that Soviet ICBM silos are hardened well beyond the level of US silos and that Soviet air defenses are vastly more extensive than those of the US. In addition to this dramatic lead in counterforce capabilities, the Soviets have also developed a "potential reload and refire capability for part of their ICBM force."

Other factors favoring the Soviets include the anti-ballistic missile defenses around Moscow, extensive networks of bunkers for the Soviet leadership and key segments of the civilian work force, and elaborate measures for dispersal of conventional forces and urban populations, according to the JCS Posture statement. Also, the Joint Chiefs reported that the "Soviet target base is significantly less vulnerable to nuclear effects than that of the US." In the aggregate, therefore, "Soviet strategic forces are more effective than those of the

### Some Major Soviet Development Programs Reaching IOC in the Mid-1980s

**STRATEGIC OFFENSIVE SYSTEMS**

SS-X-24 (MX-class) Solid-Propellant Intercontinental Ballistic Missile (ICBM)
Improved Liquid-Propellant ICBMs
SS-X-25 Small Solid-Propellant ICBM
SS-N-20 (D-5-class) Submarine-Launched Ballistic Missile (SLBM)
Typhoon (Ohio-class) Nuclear-Powered Ballistic Missile Submarine (SSBN)
Blackjack (B-1B-type) Heavy Bomber
Air-Launched Cruise Missile (ALCM)
Bear-H, Probable ALCM Carrier
SS-NX-21 (Tomahawk-class) Sea-Launched Cruise Missile (SLCM)
SS-NX-23 Sea-Launched Ballistic Missile (SLBM)
Y-Class Nuclear Cruise-Missile Submarine (SSGN) Mod

**STRATEGIC DEFENSIVE SYSTEMS**

SA-10 Surface-to-Air Missile—Mobile Modification
Modified Galosh Antiballistic Missile Interceptor
High Acceleration Antiballistic Missile Interceptor
Pushkino Very Large Antiballistic Missile Radar
Su-27 Flanker Interceptor Aircraft
Mainstay Airborne Warning & Control System (AWACS)
Abalakovo Very Large Radar

**SUPPORT SYSTEMS**

Condor Heavy Lift Transport (C-5A-type)
Candid Tanker (C-141-type)

**TACTICAL SYSTEMS**

SS-X-23 Short-Range Ballistic Missile (SRBM)
Short-Range Ballistic Missile (SRBM) Modifications
SA-X-12 Surface-to-Air Missile (SAM)
New Attack Helicopter
Electro-Optical Tactical Air-to-Surface Missile
Large Caliber Unguided Rocket
Laser-Guided Bomb
Cluster Bomb
New Mobile Self-Propelled Antiaircraft Artillery (Sgt. York-type)
Millimeter-Wave Antitank Guided Missile
SS-N-19 Long-Range Antiship Missile
Oscar-class Nuclear-Powered Cruise-Missile Submarine
SS-N-22 Short-Range Antiship Missile
Ground-Launched Cruise Missile (GLCM)
New Naval Surface-to-Air Missile
Big New Nuclear-Powered Submarine
New Medium-Size Nuclear Attack Submarine
Slava-class Cruiser
MiG-29 Fulcrum Interceptor Aircraft
AA-X-10 Air-to-Air Missile

**SPACE SYSTEMS**

Medium-Lift Space Booster
Saturn-class Heavy-Lift Booster
Space Plane
Space Shuttle
Large Space Station
Potok Communications Satellite (4gHz)
Antisatellite System

US because of asymmetries in role and doctrine and the development by the Soviets of protected and dispersed sites for essential installations, forces, and personnel," according to the Joint Chiefs' Posture statement.

### Continued Soviet Buildup

Moreover, assuming continued Soviet force modernization, even the deployment of modernized US strategic systems as presently planned won't halt the "downward slide" in US vs. Soviet counterforce capability until the early 1990s when the advent of the D-5 SLBM, the new small ICBM, and the "Stealth" advanced technology bomber will start to reverse the three-to-one, or worse, Soviet hard-target kill-potential advantage, according to the Joint Chiefs' testimony.

According to the latest Pentagon analyses, the Soviets "have more than thirty new strategic offensive systems in various states of development." Projections for the next decade include new, solid-propellant medium and small ICBMs to be based in silos as well as in a mobile fashion. Also, improvements in the currently deployed SS-18 and SS-19 ICBMs are likely to continue even though follow-on systems with greater accuracy and targeting flexibility are being developed. Two sea-launched ballistic missiles, including the huge SS-NX-23 comparable in size to MX, a new strategic bomber—the Blackjack-A—and new ground-, air-, and sea-launched cruise missiles are in advanced stages of development.

According to Secretary Weinberger's congressional testimony, the Soviets are also building new versions of the Bear bomber to carry air-launched cruise missiles while continuing to add Backfire bombers at the rate of about thirty per year. The air-breathing threat projection also includes development of land- and submarine-launched cruise missiles with ranges greater than 2,000 nautical miles.

### The Strategic Defense Initiative

The most noteworthy initiative of the FY '85 budget is a long-term probe of the feasibility of advanced strategic defense technologies, known as the Strategic Defense Initiative (SDI). The Defense Department will spend about $1.8 billion and the Department of Energy about $300 million on SDI in FY '85. For FY '86 the SDI funds are scheduled to go up to about $3.79 billion, and over the next five years total spending on SDI may reach $24 billion. The FY '85 funding, however, is about $300 million less than proposed by the Defense Department. The White House reportedly felt that the justification for some of the funding requests was not adequate.

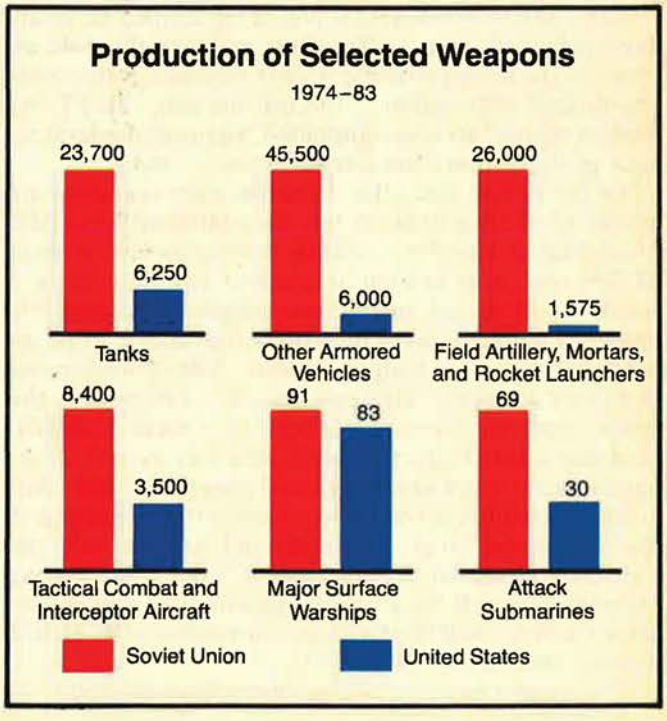
The purpose of the SDI program is to find ways to decrease the nation's reliance on deterrence by threat of retaliation by offensive nuclear weapons and to increase the contribution of defensive systems to the strategic posture. The program cuts across many technology areas, including surveillance, target acquisition and tracking, directed-energy weapons, kinetic-energy weapons, battle-management systems, survivability, lethality, target hardening, and an array of developments required for support systems.

Guiding the technology development program is a special Presidential directive that in turn is based on last year's government-wide Defensive Technologies Study. Technology development work associated with SDI will be carried out throughout the remainder of this decade, culminating eventually in the demonstration of pivotal technologies.

According to USAF's FY '85 Report to Congress, "full-scale engineering could begin early in the 1990s, followed by deployment around 2000." The report points out that the SDI project will provide the nation with flexible options to respond to potential Soviet strategic defense developments, adding that while the program's principal focus is on the ballistic missile threat, "we are also examining requirements to counter the bomber and cruise missile threat. The development and deployment of strategic defense could significantly increase deterrence and stability for both the US and our allies."

Secretary Weinberger characterized the SDI program as "a major departure from recent ballistic missile defense efforts. Previous programs emphasized point-defense systems that would protect selected military targets by intercepting reentry vehicles in the terminal phase of their flight. The new SDI program is designed to examine the feasibility of a system that could engage ballistic missiles and their warheads along their entire launch-to-impact trajectories." Since the program is a research and development effort, Secretary Weinberger told Congress, "it can be fully pursued for the next several years within existing [arms-control] treaty constraints."

The program, he announced, will have a single manager who reports directly to the Secretary of Defense: "The manager will oversee the preparation and execution of the budget and will have the authority to reprogram resources to more promising technologies, if necessary. He will also serve as the Department's focal point for reporting to Congress on the program's progress and on actions requiring congressional review." He explained that while the SDI program will be centrally



controlled, "the services and defense agencies will participate in the budget formulation process and will have responsibility for executing their portions of the program."

A central factor behind the SDI effort is that the "Soviet Union has pursued advanced ballistic missile defense technologies for a number of years and is the only country maintaining an operational ballistic missile defense. Unilateral Soviet deployment of an advanced system capable of countering Western ballistic missiles—added to their already impressive and passive defense capabilities—would weaken deterrence and threaten the security of the US and its allies. Thus US research efforts will provide a necessary and vital hedge against the possibility of such a one-sided Soviet deployment. In addition, our effort could provide a potentially powerful tool to moderate the development of future offensive systems and to make the world more stable and secure," Secretary Weinberger told Congress.

He summed up the case for SDI by stressing that "an effective defense against ballistic missiles can have far-reaching implications for enhanced deterrence, greater stability, and improved opportunities for arms control." He added that "our efforts do not seek to replace proven policies for maintaining peace, but to strengthen their effectiveness in the face of a growing Soviet threat. The essential objective of the US strategic defense initiative is to diminish the risk of nuclear destruction and to provide for a more flexible, less menacing way of preventing nuclear war in the decades to come."

### Strategic Offensive Forces

The US, while working toward preserving its strategic deterrence capabilities, can't afford to ignore the possibility of deterrence failures. Under such conditions, Secretary Weinberger told Congress, "we cannot predict the nature of a Soviet nuclear strike or ensure with any certainty that what might begin as a limited Soviet attack would remain confined to that level. We must plan for flexibility in our forces and in our options for response, so that we might terminate the conflict on terms favorable to the forces of freedom, and reestablish deterrence at the lowest possible level of violence, thus avoiding further destruction." Toward this end, the FY '85 budget request stresses continued, vigorous modernization of the nation's nuclear deterrence forces.

In the ICBM area, the Administration is requesting about $5,852.8 million to buy an additional forty MX Peacekeeper missiles, continue development of a small ICBM (SICBM) and an associated mobile launcher, work on advanced basing technologies, and continue modest modifications of the Minuteman ICBM force. In addition, the new budget requests $108.4 million for R&D on advanced strategic missile systems—in the main, work on maneuvering reentry vehicles (MaRVs) that can evade ballistic missile defenses as well as increase accuracy, and on advanced penetration aids. Another $80 million is sought to continue the retirement of the remaining Titan II ICBMs and to dismantle the associated silos. Under the terms of SALT I, by drawing down the Titan II force and dismantling the deactivated silos the Navy will be able to up the number of its SLBM launch tubes from 656 to 710.

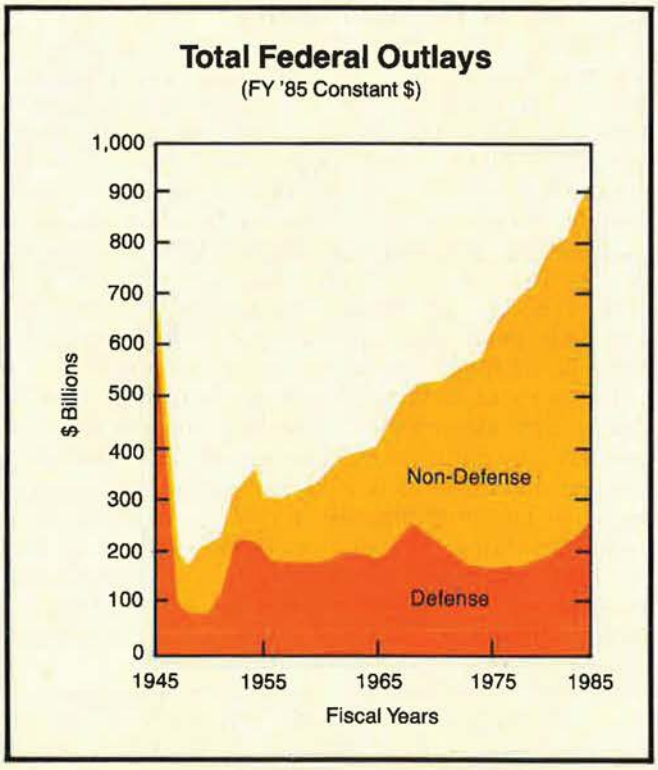
The budget envisions initial operational capability of the MX—involving ten missiles in Wyoming—in December 1986, with the remaining ninety missiles to be deployed by 1989. Of the 100 Peacekeeper missiles planned by the Administration, sixty-nine are to be deployed in Wyoming and thirty-one in Nebraska. (This plan could be delayed or otherwise affected by a recent request by the governors of Nebraska and Wyoming that the Administration delay the missiles' deployment schedule by one year to bolster the prospects for arms-control negotiations with the new leadership of the Soviet Union.)

Procurement and deployment of MX already suffered a setback last year when Congress limited procurement of Peacekeeper to twenty-one in FY '84 instead of the twenty-seven requested by the Administration. Overall, the Administration plans to acquire 223 MX Peacekeeper missiles, of which 100 are slated for deployment in existing Minuteman silos, 108 are earmarked for operational testing, and fifteen are set aside for "aging and surveillance." Flight testing of this four-stage, 195,000-pound missile (three solid stages plus a liquid one) got under way in June 1983 and, according to a Defense Department report to Congress, has been "outstanding at this early stage of the test program."

Scheduled to carry ten Mk 21 RVs—each designed for a yield of about 500 kilotons but for the time being scaled back to a lower yield to conserve the scarce special nuclear materials (SNM) needed to trigger the weapon—Peacekeeper is critically important to redress Soviet superiority in hard-target kill capability as well as a means for encouraging Moscow to negotiate arms reductions, according to the FY '85 Defense Report.

### The Small ICBM

The strategic weapons program that is most likely to be scrutinized carefully by Congress is the small ICBM. The Administration is seeking $465.2 million for the



SICBM program in FY '85. In the following year, $482 million is earmarked for this single-warhead missile that is scheduled to enter full-scale development in late 1986 or early 1987. Despite repeated assurances by the Air Force to the contrary, there is a tendency in Congress to question the Pentagon's commitment to this weapon system and to imply that the Air Force would rather buy additional Peacekeeper missiles.

USAF's FY '85 Report to Congress countered this misperception by stressing that the Air Force is managing this program "as a matter of high national priority" and pointed out that "we have assigned the highest defense and industrial priorities to avoid supply delays, and are streamlining management channels to avoid administrative delays." Emphasizing that a special major program office for the SICBM has been established at Norton AFB, Calif., by Air Force Systems Command, the Air Force told Congress that "the number of people working in this office will double this year and we plan to have a general officer head this program by mid-year."

Secretary Weinberger, in his report, put similar emphasis on this program and said that the weight of the weapon would be held to about 30,000 pounds to ensure "its compatibility with a mobile basing system." Explaining that several competitive design concepts for both the missile itself as well as for the basing vehicles and structures are being pursued, he said, "At the same time, we are looking at the requirements for the system as a whole, including its concept of operations, $C^3$ support requirements, and its potential impact on the environment."

The SICBM, according to the Pentagon, will be about forty-four feet in length, four feet in diameter, and have a throw-weight of approximately 1,000 pounds, which allows it to carry the Mk 21 RV. After the competitive development process has been narrowed to a single design, flight testing of complete systems should get under way late in 1988, leading to initial operational capability in 1992, according to a Defense Department report to Congress.

### Basing SICBM

Several major technical challenges associated with the mobile SICBM concept are being worked by the Air Force. The Defense Department report points out that it is as yet unclear whether "a vehicle hard enough to permit basing on Department of Defense lands is feasible." Previous approaches to mobile ICBM concepts involved conventionally designed launch vehicles that could not withstand the seventy to 100 mph winds that spread over large areas following a nuclear detonation. This, in turn, would require dispersal of the missiles over a large operating area—between one and two million square miles—to ensure sufficient survivability of the force against a large-scale Soviet attack. The concomitant logistics support and public interface problems militate against such an approach.

If, on the other hand, it is possible to design mobile launch vehicles that can withstand tens of pounds per square inch (psi) overpressures and the associated 600–900 mph winds, the lethal radius of an attacker's warhead is reduced sharply and the operating area of the system can be squeezed into Department of Defense land holdings. The Air Force, therefore, is examining several vehicle designs to determine which provides the best combination of mobility and resistance to these nuclear effects.

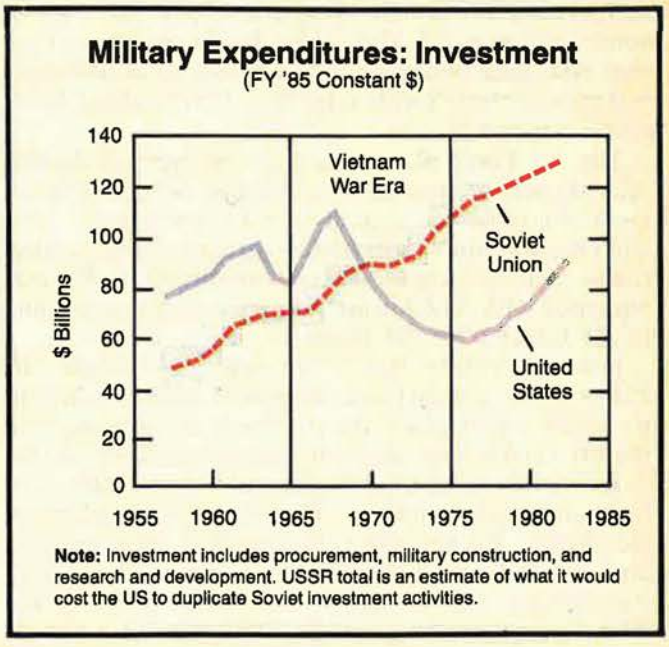
These designs incorporate a variety of shapes and mechanisms and put special emphasis on the seal the vehicle forms with the ground. The Defense Department report pointed out that a "near-perfect seal is required to prevent airflow under the vehicle that could cause it to flip over." As a result, several different sealing and anchoring mechanisms are being investigated.

The same kind of survivability and hardness will be required of the ground-mobile launch control center that must be deployed and dispersed with each SICBM launch vehicle. The ground-mobile launch center will function in a manner similar to the fixed and hardened launch control centers of the present generation of silo-based ICBMs. An alternate link will rely on the Airborne Launch Control Centers for direct or indirect two-way communications with the launchers.

The technical challenges associated with the design of hardened mobile launch and control vehicles make it imperative that advanced hardened silo development be carried out in parallel to ensure that an effective basing mode will be available when the missile is ready for deployment, according to the DoD analysis.

By July 1984 all major contractors of the SICBM program will be picked by the Air Force. About thirty contractors will be involved, including two assigned to the design of suitable MaRVs and guidance and control. Initially, the SICBM will use a lightweight derivative of the Peacekeeper's AIRS (advanced inertial reference sphere) system. Alternate systems, such as ring-laser gyroscopes and stellar inertial (star-tracking) guidance, are to be examined for incorporation into the system later on.

In terms of the sea-based strategic nuclear forces, the new budget request provides for the acquisition of another (the twelfth) Trident ballistic missile submarine (SSBN) at a cost of about $1.8 billion. In addition, the budget seeks about $2.25 billion for development and long-lead procurement of a new SLBM, the Trident II,



**Note:** Investment includes procurement, military construction, and research and development. USSR total is an estimate of what it would cost the US to duplicate Soviet investment activities.

or D-5. No more Trident I (C-4) SLBMs are to be authorized.

The first eight Trident SSBNs—three of which are already at sea—are to be equipped with Trident I SLBMs initially, while the Trident II will be deployed on all new Trident boats, starting with the ninth. The Trident II SLBM eventually will be retrofitted into the first eight Trident submarines. According to Secretary Weinberger, the Trident II has a greater throw-weight and "is more accurate than the Trident I, thus providing the SSBN force with the capability to put hard targets at risk." Initial deployment of the Trident II SLBM is scheduled for 1989.

### The Air-breathing Leg

Not counting the funding of the "Stealth" advanced technology bomber (ATB) that is not made public for security reasons, modernization of the air-breathing leg of the triad is pegged at about $10.15 billion. Of this amount about $8.2 billion is requested for the multiyear procurement of thirty-four B-1Bs (B-1Bs 19 through 52), initial spares, and the FY '85 portion of full-scale development. The B-1B flight-test program will begin in early FY '85 and emphasize flight test and cruise-missile integration. During the same period, nuclear certification, weapons delivery testing, terrain following/avoidance certification, and activation of the first B-1B operating base at Dyess AFB, Tex., are to be accomplished.

The unclassified version of USAF's FY '85 Report to Congress deals rather circumspectly with ATB, acknowledging only that it will "extend the essential advantages of manned bomber weapons delivery into the twenty-first century." The report reveals that the Air Force has selected the "prime contractor [Northrop] and key members of the ATB development team, [and] program start-up is progressing smoothly. While most details of this program are highly classified, the essential point is that the ATB will be . . . using low-observable techniques to negate present and projected Soviet air defenses. The technologies involved are exciting and promising, even though they are still in the early developmental stages and represent a technological advance with extraordinary military significance. In the 1990s, a combined force of B-1Bs, ATBs, B-52s, and cruise missiles will place maximum stress on Soviet air defenses and provide the US with a significant and resilient deterrence capability."

The Air Force plans to acquire no more AGM-86B ALCMs and is concentrating instead on the development of a follow-on system—the advanced cruise missile (ACM), which will feature greater survivability, range, and accuracy. Three squadrons of B-52Gs equipped with ALCMs are now operational, according to the USAF's FY '85 Report.

Plans to transfer SAC's sixty-one operational FB-111As to the tactical forces have been deferred. In contrast with earlier plans, the Air Force now stresses that the FB-111A is a key element of the strategic forces that "can provide accurate, low-altitude weapon delivery at night and in poor weather." Hedging on future plans for the aircraft, the new report asserts that, because of the dual capabilities of the FB-111A, "we will consider transferring these aircraft to the tactical forces as the ATB deployment draws closer." Whether these aircraft remain in the strategic forces or move to the tactical forces, they require modernization in the areas of avionics, engines, and escape capsule, according to the FY '85 USAF Report. About $206 million is being requested for that purpose.

The Advanced Air-to-Surface Missile (AASM) program, for which $55 million is sought, is the only new start this year in the strategic sector. AASM is needed, according to the Air Force, to "supplement and eventually replace the aging Short-Range Attack Missile (SRAM). We must have more modern warhead safety, and we can improve performance with relatively low technological risk by incorporating advances in low-observable technology, navigation systems, propulsion efficiency, and accuracy." AASM will enable penetrating bombers to strike a "larger variety of targets," the Air Force reported.

In support of naval antisurface warfare operations, thirty B-52s are being modified to carry the Harpoon missile. A number of modified B-52Gs have been assigned to Loring AFB, Me., for Atlantic operations. As additional aircraft are modified, other B-52Gs capable of carrying Harpoon missiles will also be based at Andersen AFB, Guam, for Pacific operations, the Air Force reported to Congress. The Air Force is procuring eighty-five Harpoon missiles for this purpose in FY '85.

### The Military Space Challenge

In July 1982, the White House issued a new National Space Policy that resulted in both the Air Force and the Navy setting up space commands to centralize space activities and to gain national objectives, such as "pursuing a vigorous R&D program to give us future options in space; placing in space those functions that can be accomplished there better or at a lower cost; and developing an antisatellite system to assure our free access to space and deter Soviet attacks against our satellites."

USAF's FY '85 Report goes a step further and, in line with a similar JCS decision, asserts that "after an extensive review of command arrangements for space, the Air Force recommends a unified space command be formed soon." The US Navy's annual report to Congress, while underscoring the importance of space to maritime operations, contains no reference to plans for a unified space command.

The Joint Chiefs of Staff express major concern in their Military Posture statement about Soviet space capabilities. They assert that in addition to possessing the world's only operational antisatellite system (ASAT), the Soviets "are also believed to be capable of attacking satellites in near-earth orbit with direct-ascent ABM interceptors." The statement warns that vigorous Soviet R&D efforts in ground-based and space-based directed-energy technology have "potential ASAT" applications. That, the JCS report points out, is true also for Soviet ICBM systems. Lastly, the Joint Chiefs point out that "some US satellites may also be vulnerable to interference from jammers or damage from ground-based systems."

The Military Posture statement adds that "Soviet space systems have potential application during crises and situations short of general nuclear war because they provide command authorities with order of battle, warning, target location, and battle damage assessment infor-

mation." Because of Soviet emphasis on space as a warfighting medium and increased US reliance on space systems, this country reevaluated the military command structure supporting space operations. As a result, the Joint Chiefs of Staff are establishing a "Joint Planning Staff for Space" to improve overall military planning for space operation, presumably an interim step until a unified Space Command is set up.

The JCS express concern also about Soviet capabilities needed to support a permanently manned space station because "research and development, reconnaissance, operations of weapons and sensors, and other military missions could be performed from such stations." As a concrete counter to Soviet military space activities, the Air Force is developing a US ASAT. The new budget seeks $143 million in FY '85 and $102 million in FY '86 for this program.

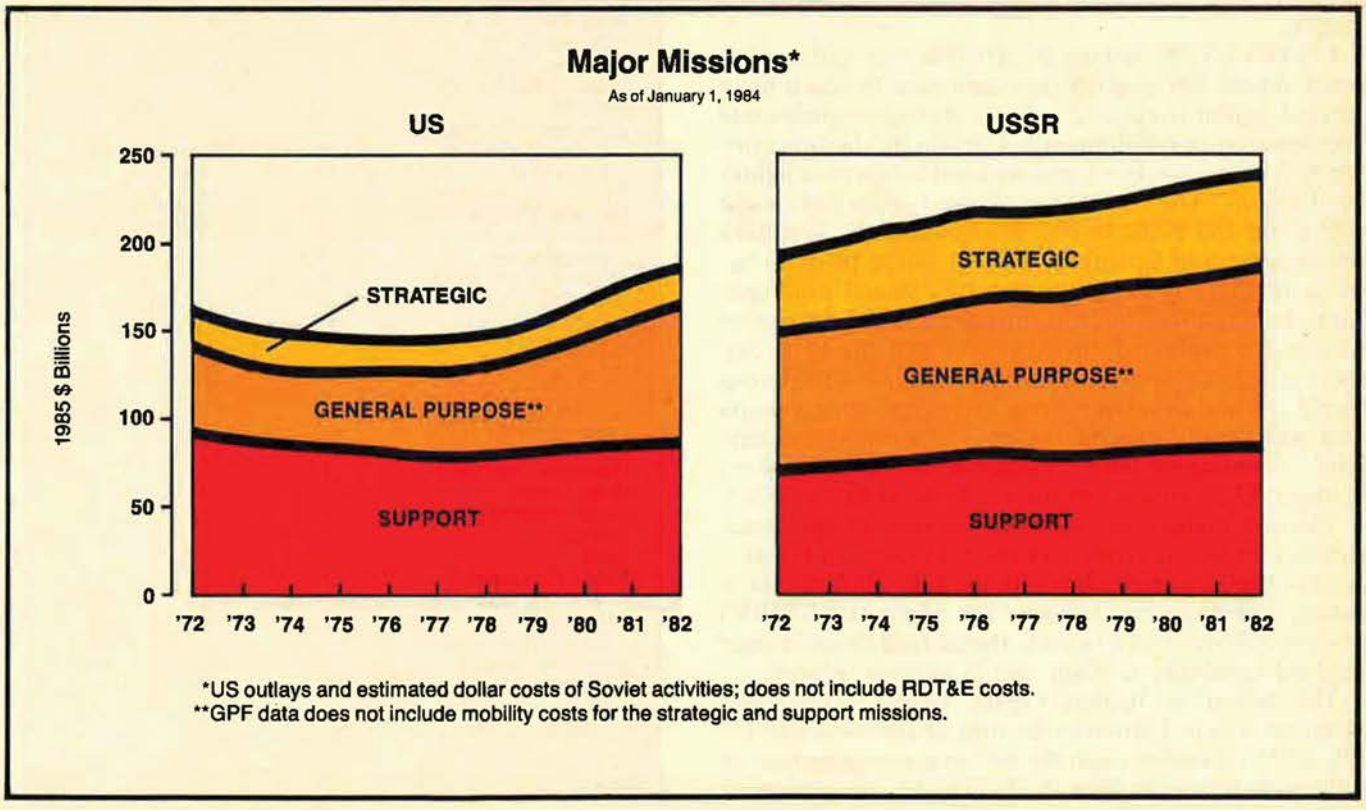
According to Secretary Weinberger, "successful completion of this program will give us the means of destroying Soviet satellites orbiting at low altitudes, thereby enhancing deterrence against Soviet use of ASAT weapons." Explaining that the program is in the test and evaluation phase, he said the Air Force plans to begin procuring the system in FY '85 and to make necessary improvements in associated $C^3$ systems. For the long run, he added, the Pentagon is assessing the feasibility of advanced technologies, such as space-based lasers, for the ASAT mission.

### $C^3$ and ELVs

In the area of strategic $C^3$—which relies largely on space-based systems—the new budget request seeks about $1.8 billion in FY '85 and $2.35 billion in FY '86. Key improvements include the acquisition of replacement satellites for the Defense Support System that incorporate improvements in the sensor's focal plane and additional hardening. These satellites in geosynchronous orbit use infrared sensors to detect ICBM and SLBM launches and transmit warning data to fixed ground stations that are extremely vulnerable to precursor attacks. Secretary Weinberger reported that "to reduce our dependence on these vulnerable facilities, we will deploy six mobile ground terminals (MGTs) to receive, process, and disseminate missile-warning data. By the end of FY '85, we will have procured all six MGTs and begun operational testing and evaluation of the system."

In a related move, the Pentagon is improving the ability to detect, locate, and report nuclear detonations on a global basis by "procuring new, more accurate and survivable nuclear-detonation detecting sensors for the satellites of the Navstar Global Positioning System (GPS)." These new Nuclear Detection System (NDS) sensors will be able to provide nearly instantaneous information about the scale and location of aboveground nuclear explosions in any part of the world. These sensors, Secretary Weinberger said, "will contribute to nuclear test-ban monitoring in peacetime and would provide damage and strike assessment information to our command posts in the event of nuclear attack. The FY '85 program includes installation and integration of the NDS sensors in the GPS host satellites. The system will become fully operational in the late 1980s."

FY '85 Air Force activities in the field of launch vehicles include continued development of the inertial upper stage (IUS), a joint development program with NASA for a common Centaur G upper stage that will boost payloads into high-energy orbits exceeding the capacity of the Space Shuttle, and augmentation of the Space Shuttle with expendable launch vehicles (ELVs). For this purpose, the Air Force is "working with other users to develop a plan that would assure access to space



for essential satellite programs. The plan calls for the procurement of at least two commercially available expendable launch vehicles (ELVs) a year for at least five years." A total of $10 million is sought for this purpose in FY '85.

To back up the Shuttle in future military space operations, the Air Force has launched the Advanced Military Spaceflight Technology (AMST) program. Funded at a modest $2.8 million, this program will pursue "the technologies necessary to provide flexible, responsive, survivable access to space," according to USAF's FY '85 Report.

### Fighter Acquisition

The new budget request stresses modernization and expansion of the tactical air forces and holds out the promise of fleshing out these forces from their present level of thirty-six active, National Guard, and Reserve wings to forty by the "1990s." The total inventory of Air Force, Navy, and Marine Corps fighters and attack aircraft is to reach 4,251 by the end of FY '85. The Air Force's share of this total is to be 2,646 PAAs (primary aircraft authorized). In addition, 270 interceptor aircraft will be assigned to strategic defense.

USAF's fighter force at present consists of thirty-seven wing equivalents—twenty-five in the active force and twelve in the reserve components. Over the next five years this total is to be boosted to the equivalent of forty tactical fighter wings, comprised of twenty-seven active and thirteen ANG and Reserve wings. In support of the fighter forces, the Air Force operates two electronic warfare squadrons, five defense suppression squadrons, fourteen tactical reconnaissance squadrons, eleven tactical command and control squadrons, and eight Special Operations Forces (SOF) squadrons. This support force is to be increased by one reconnaissance squadron and extensively modernized by the end of the decade.

USAF's FY '85 Report asserts that "we will need to build almost 300 new fighters each year to reach forty tactical fighter wings and support strategic defense and reconnaissance requirements. Current production rates are well below this level, and we need to increase fighter production." The new budget request seeks forty-eight F-15s and 150 F-16s in FY '85. In addition, Secretary Weinberger told Congress, the Air Force plans to acquire another 372 F-15s through FY '89 and will "continue buying these aircraft into the 1990s." In similar fashion, he explained, the Air Force will buy F-16s at a more economical rate—216 aircraft per year—beginning in FY '86 and develop a "cranked-arrow-wing version that will greatly expand the aircraft's range and payload." Funding for the F-15 acquisitions in FY '85 is set at about $2.23 billion and for the F-16s at $4.23 billion.

The new budget also seeks $27 million for the "dual-role fighter"—a derivative of the F-15 *(see "In Focus," p. 22)*—that in conjunction with the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system will boost significantly the tactical forces' range/payload capability at night and in adverse weather.

The Advanced Tactical Fighter (ATF) technologies program is to be funded to the tune of $94 million in FY '85. ATF is meant to point the way to a new generation of fighters to take over from the F-15 and F-16 when these aircraft reach obsolescence. Current Air Force plans are to enter ATF in full-scale engineering development in FY '89 and to achieve IOC in FY '95.

The Navy seeks to acquire twenty-four F-14s and eighty-four F/A-18s and the Marine Corps plans to buy eighty-four AV-8B V/STOL attack aircraft in FY '85, with a combined price tag of about $4.87 billion.

### Other Tactical Programs

The first acquisition of the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)—174 missiles at a procurement cost of $431 million—is sought in FY '85 by the Air Force. Eventually the F-14, F-15, F-16, and F/A-18 will carry this missile that incorporates an active radar seeker to permit launch-and-leave operation. The AIM-120 is replacing the AIM-7 radar-guided missile.

Noteworthy among the host of tactical air warfare programs is continuing acquisition—two aircraft in FY '85 and four in FY '86—of the MC-130H Combat Talon II. This heavily modified C-130 aircraft operated by the Special Operations Forces is equipped with precision-navigation, terrain-following, and self-protection systems that enable it to penetrate enemy airspace at night and at low altitude. Its primary mission is to drop combat personnel and equipment behind enemy lines. By FY '91, thirty-five of these aircraft will be available to the Special Operations Forces, according to Secretary Weinberger.

In the related electronic warfare area, the new budget

**Comparison of Key Military Technologies**

| BASIC TECHNOLOGIES | US Superior | US-USSR Equal | USSR Superior |
|---|---|---|---|
| Aerodynamics/Fluid Dynamics | | X | |
| Automated Control | | X | |
| Chemical Warfare | | | X |
| Computer | X | | |
| Conventional Warhead (including Chemical Explosives) | | X | |
| Directed Energy (Lasers) | | X | |
| Electronic Warfare | X | | |
| Electro-Optical Sensor (including IR) | X | | |
| Guidance & Navigation | X | | |
| Microelectronic Materials & Integrated Circuit Manufacture | X | | |
| Nuclear Warhead | | X | |
| Ocean Science | | X | |
| Optics | X | | |
| Power Sources (Mobile) | | X | |
| Production Manufacturing | X | | |
| Propulsion (Aerospace) | X | | |
| Radar Sensor | X | | |
| Signal Processing | X | | |
| Software | X | | |
| Space | X | | |
| Stealth (Signature-Reduction Technology) | X | | |
| Structural Materials (Light weight, high strength) | X | | |
| Submarine Detection | X | | |
| Telecommunications | X | | |

X indicates US lead is diminishing

As of January 1, 1984

**MILAN.**
**Anti-tank missile system for use by the infantry.**

**ROLAND.**
**Guided missile system mounted on a shelter for use against low-flying aircraft.**

**MW-1.**
**Multipurpose weapon system to be used on the Tornado.**

**CGIVS.**
**Computer-generated image visual system for the Tornado training simulator.**

# Our High-Tech Contribution to Defense.

The target: Utmost economy in defense.
The procedure: Cooperation as a NATO partner.
The principle: Applied system design responsibility.
The result: High-Tech Weapon Systems.

MBB and its Partner Companies.
This stands for successful cooperation in the fields of anti-tank and air defense, ground attacks and anti-ship operations as well as electronic systems and components.

HOT and MILAN: Anti-tank missile systems of long and medium ranges, respectively.
ROLAND: Surface-to-air missile system for use against low-flying aircraft.
MW-1: Conventional multi-purpose weapon for anti-tank defense.
KORMORAN: Air-to-ship guided missile.
CGIVS: Computer-generated image visual system.

**MBB Washington Office:**
**Suite 906, 1625 Eye Street, N.W.**
**Washington, D.C. 20006**
**Telephone (202) 293-7741**

MBB

Partner in international programs

# HERTZ HELPS CUT TRAVEL COSTS FOR AFA MEMBERS!

FROM

**$27.50** Per Day Subcompact UNLIMITED MILEAGE

**$69.00** Per Week Subcompact UNLIMITED MILEAGE

You can save good dollars every time you rent a Hertz car. Your Hertz Government Personnel discount is valid **for both official and personal travel** throughout the world. Rates start at just **$27.50** a day for subcompacts, with larger cars available for slightly more. The $69 is the Florida Weekly Affordable Rate and requires seven days advance reservation. Slightly higher weekly affordable rates apply throughout the rest of the USA.

To receive your discount, show your Government ID or Hertz ID card at the Hertz counter. You'll get all the #1 services, including unlimited mileage.

If you are working or stationed abroad, ask about our international discount rates.

Hertz also has attractive weekly and monthly rates.

For reservations or information, call toll-free in the U.S.A. 800-654-3131, from Oklahoma, 1-800-522-3711, from Alaska and Hawaii, 800-654-8200.

Hertz Government Personnel rates and discounts are available at all corporate and participating licensee locations. Cars must be returned to a Hertz location in the renting city to obtain maximum discount. Gasoline, local taxes, refueling charges, optional Collision Damage Waiver, Personal Accident Insurance and Personal Effects Coverage are not included. These rates are not discountable and are subject to change. On one-way rentals, and rentals of other car classes, a 20% discount off Hertz Standard Unlimited Mileage Rates will be given. There may be a drop-off charge on some one-way rentals.

**Hertz Government Personnel Discounts**
**The Hertz Corporation**
**700 N. Fairfax St., Suite 410**
**Alexandria, VA 22314**

Please send me:
- ☐ Hertz #1 Club Credit Card Application(s)
- ☐ Hertz Government Personnel Discount ID Card(s)
- ☐ Other _____

NAME _____

TITLE/RANK _____

DEPARTMENT/BRANCH _____ (AFA)

TELEPHONE (___) _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____ COUNTRY ____

Hertz®

**The #1 way to rent a car.™**

Hertz rents Fords and other fine cars.

provides for the acquisition of a final complement of 500 Pave Tiger minidrones. With no acquisition of this defense suppression weapon sought for FY '86, the total inventory of these weapons presumably won't exceed 1,000, counting the procurement of the past two years. Secretary Weinberger described Pave Tiger as "a small, ground-launched, expendable drone aircraft designed to suppress or destroy elements of enemy air defense networks." He added that "the Israelis' recent success in employing drone systems against Syrian ground-based air defenses illustrates the excellent potential of these vehicles."

Modernization of the conventional warfare capabilities of the Army sought by the new budget includes the acquisition of 720 M-1 tanks and 710 Bradley armored fighting vehicles. In addition, the Army plans to acquire 144 AH-64 Apache attack helicopters equipped with the Hellfire antiarmor system, along with another 156 assorted multipurpose copters.

The Navy's deployable battle force is to reach a 545-ship inventory in FY '85, up by twenty over the current level, and the long-sought goal of 600 ships by the end of the decade.

### The Airlift Improvement Program

The current fleet of 322 C-5, C-141, and KC-10 long-range cargo aircraft augmented by 108 cargo aircraft of the Civil Reserve Air Fleet (CRAF) provides a total capacity that is less than half of the 66,000,000-ton-miles-per-day (MTM/D) capability deemed essential by Congress. The FY '85 budget calls for the acquisition of another ten C-5Bs at a cost of about $2.2 billion, eight KC-10s priced at $647 million, and R&D funding of the C-17 to continue development of this modern cargo aircraft toward an FY '92 IOC, according to Secretary Weinberger. An additional $128 million is sought by the Air Force to retrofit four Boeing 747s to a cargo-convertible configuration as part of the CRAF enhancement program. All told, twenty aircraft—one DC-10 and nineteen Boeing 747s—are slated to be modified in this manner during the new Five-Year Defense Plan.

Combined with plans for continued acquisition of C-5Bs for a total of fifty aircraft and KC-10s for a total of forty-four, MAC's capacity is expected to increase to about 50,000,000 ton-miles per day by FY '89. At present, the Joint Chiefs' of Staff Military Posture statement points out, "Military Airlift Command has been unable to attain high, sustained airlift utilization rates to support wartime planning because of shortages in many areas." Despite the CRAF enhancement program and the acquisition of additional C-5Bs and KC-10s, "there will continue to be shortfalls in the achievement of intertheater minimum objectives as well as deficiencies in intratheater airlift capacity. As the airlift fleet continues to age, modernization will become a major concern," according to the Joint Chiefs' report.

The C-17, the JCS statement points out, is needed to offset the airlift shortfall by providing "increased intertheater and intratheater capability to deliver troops and cargo to field commanders, and an outsize airdrop/low-altitude parachute-extraction capability." The Joint Chiefs added that the air-refuelable C-17 has "excellent ramp maneuverability and takeoff-and-landing profiles designed to allow routine operations from small, austere airfields." As a result this new aircraft will be able to take the place of both the C-130s and C-141Bs when they reach the end of their useful service life.

Capacity shortfalls in airlift are being exacerbated by a decline in sealift. This deficiency is the result of the decline of the US-flag merchant marine fleet that shrank over the past thirty years from 2,400 bottoms to 440, according to the Joint Chiefs. In addition, the 186 ships in the National Defense Reserve Fleet—many of them of World War II vintage—are aging. Programs to increase the sealift forces, such as conversion of the eight superfast SL-7-class container ships to a roll-on/roll-off configuration and modernization of the National Defense Reserve Fleet, are being funded in FY '85 but won't fully offset the shortfall over the near term, according to the Joint Chiefs.

To overcome limitations of both airlift and sealift, prepositioning of petroleum, ammunition, equipment, and other essential supplies in various regions of the world will, therefore, continue. In the case of Europe, the POMCUS (prepositioning of material configured in unit sets) program is being increased to cover six Army divisions. Prepositioning of material aboard Maritime Prepositioning Ships (MPS) continues apace.

The newly created Joint Deployment System, designed to give the National Command Authorities and the JCS an increased ability to make changes in force allocations, schedules of lift requirements, and force deployments, will reach full operational capability in FY '85, according to the Military Posture statement.

### Defense Activities of DoE

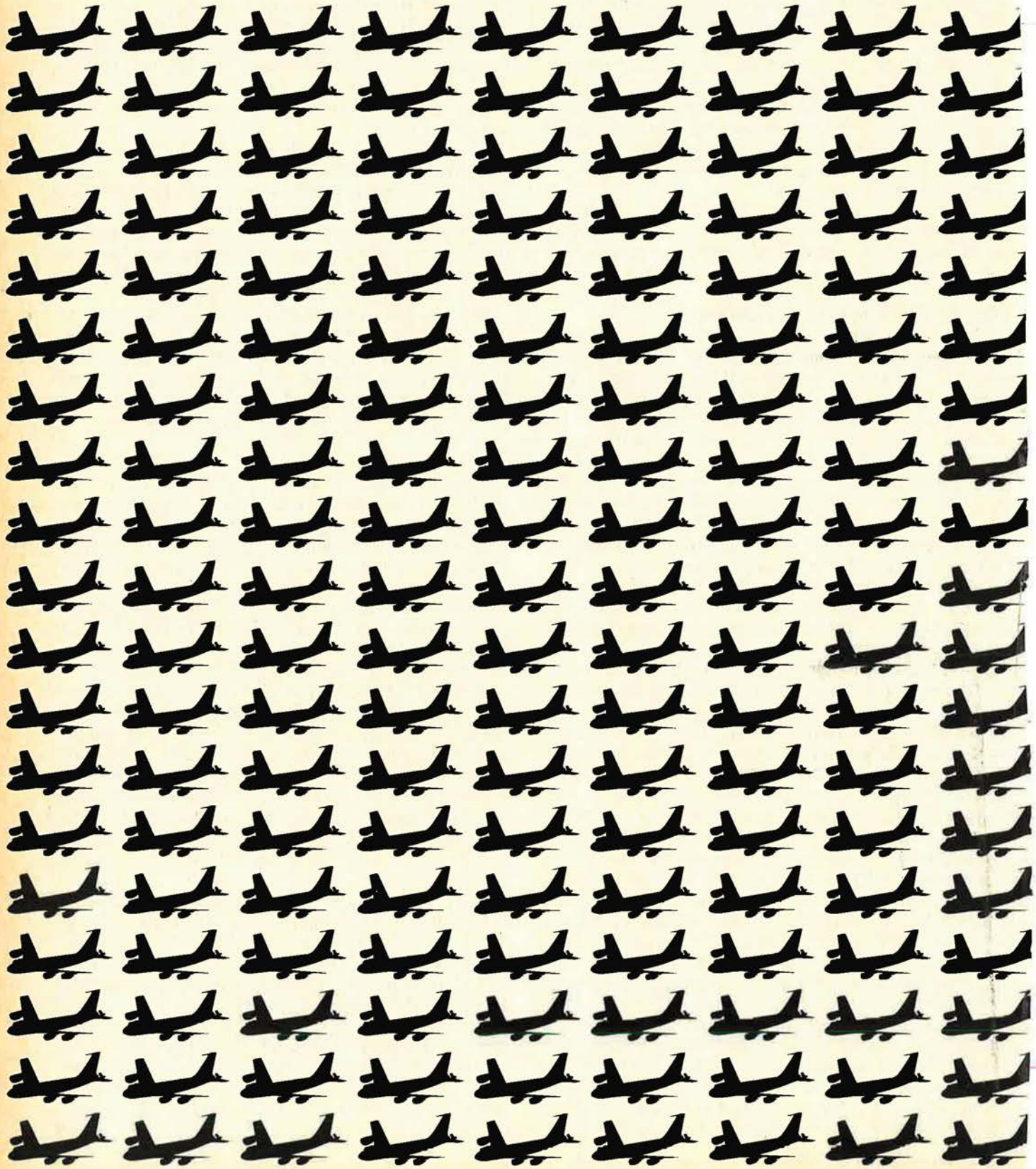
The Department of Energy's program of R&D and production of nuclear weapons and materials in support of Defense Department requirements seeks FY '85 funding (in budget authority) of about $7.8 billion, up by about $1.4 billion over FY '84. The single largest increase is in the weapons program—up by about $800 million—and includes about $1.7 billion supporting "efforts to explore the . . . strategic defense initiative [SDI] and initiate the Nuclear Weapons Research, Development and Testing Facility Revitalization project."

Weapons programs in progress include two versions of the B-61 bomb, the W76 Trident I warhead, the W79 eight-inch artillery fired atomic warhead, the W80-0 sea-launched cruise missile warhead, the W80-1 air-launched cruise missile warhead, the B-83 bomb, the W84 ground-launched cruise missile warhead, and the W85 Pershing II warhead. Also scheduled for FY '85 is preproduction work on the W87 warheads of both MX and the Trident II SLBM as well as on the W81 Standard Missile 2 warhead.

Other DoE defense activities—funded to the tune of $138 million—center on inertial confinement fusion research, which involves a laser or particle-beam generator as the trigger for nuclear fusion. DoE seeks another $1.86 billion for the production of nuclear materials needed by the Defense Department.

In summary, the Joint Chiefs provided a perceptive analysis of the FY '85 budget when they testified that "the proper balance has been struck—the balance between providing for present needs in readiness and sustainability and ensuring future capabilities through modernization." ■

# HOW TO GET 300
# WITHOUT BUILDING



# MORE TANKERS A SINGLE AIRPLANE.




With retrofitted fuel-efficient engines, two Boeing KC-135s can now do the work of three.

That means our present force of 600 tankers can handle the job of 900.

It's the most cost-effective means available to help solve our country's refueling shortfall.

In addition to significant energy savings, a retrofit will decrease atmospheric pollution, reduce noise, improve lift capacity, and substantially lower maintenance and operational costs.

Production of the KC-135R is already underway. It's right on schedule and well within budget.

At Boeing, we believe that's exactly the kind of cost savings this country needs.

**BOEING**

*Professor in blue Capt. Allan W. Howey leads the discussion during a history class.*

# Four Pillars of Excellence

## In thirty short years, the Air Force Academy has become a leader among educational institutions, but its success story goes beyond that.

**BY LT. COL. BILL WALLISCH, USAF**
**Photos by TSgt. Guido Locati, USAF**

I'M A professor, a professor in blue. I teach English and communication at your United States Air Force Academy. Last year I had the unique opportunity to spend a sabbatical at a civilian university as an American Council on Education Fellow. For really the first time, this gave me the opportunity to compare the Air Force Academy with the rest of American higher education.

One of forty ACE Fellows, I spent my year as assistant to the chancellor of the University of Pittsburgh. Part of my assignment was to visit other campuses, meet with administrators at those schools, and sample the "mood" of American higher education in general. I knew before I started the sabbatical that the Academy would stack up well against other schools, but I hardly expected it to stack up so very well.

I don't want to suggest that we're know-it-alls at the Academy, or even suggest that I didn't see scores of outstanding programs around the country. However, that year "abroad" showed me that our Air Force Academy is in step with the best of the best. The educators I met that year perceived the Academy on the leading edge of educational excellence.

Dr. Jack Gourman, a professor who annually rates some 1,800 institutions in his *Gourman Report*, was quoted recently in the *Higher Education Daily* as saying that the Air Force Academy is "right up there with the top colleges in the nation." He said also that he was impressed by the Academy's sound curriculum and leadership.

Everywhere I briefed our programs during my sabbatical the reaction was similar. A few college presidents were even so surprised at our pedagogical depth that they booked themselves on airplanes and made their way out to the Academy to get a firsthand look. When I saw them later, they'd smile and say, "You were absolutely right!" The Academy makes that kind of impression.

I'd like to review some of the things we're doing at the Air Force Academy and present a progress report at the thirty-year mark. That's right—the Academy is thirty years old this year.

## The Mission

The great Spanish scholar José Ortega y Gasset wrote in his *Mission of the University* that a curriculum should bring students to the "height of their times." Here at the United States Air Force Academy, we have a curriculum that truly does that for our students. In fact, the Air Force Academy could well serve as a model for other institutions to emulate in this dynamic and turbulent period of American higher education.

The first thing one notices about the Academy's overall program is that it's very confident about its mission: to motivate and train career officers for the United States Air Force. Few institutions of higher education in America are so singular in their approach. The Academy is, in essence, a school that is directly sponsored by a "parent company." In other institutions, students may have a vague idea of where they might work after graduation, but at the Academy, you *know* what your career will be after graduation. Program focus at the Academy is clear.

The professors at the Air Force Academy do not wear the flowing black robes worn by their colleagues elsewhere. At the Academy, the professor wears the uniform of the United States Air Force, a constant reminder that all teachers are teaching their students to become officers in the United States Air Force. Almost all of our professors come from the Air Force and return to the Air Force. No matter if the lesson is Shakespeare, quantum mechanics, organic chemistry, or astronautics, the professor in blue can relate the lesson of the day to the career of an Air Force officer.

More than thirty percent of the professors at the Air Force Academy have doctorates, and all others on the 585-member faculty have master's degrees. All are recognized as experts in their fields. For the sake of stability, there are also twenty-one permanent professors (the department heads and the dean) and a number of tenured associate professors who constitute about ten percent of the overall faculty. Each is a scholar, but an Air Force officer first.

Civilian colleagues are amazed at our publications and research credits. But the emphasis here is always on excellence in undergraduate education. The North Central Association—the body that certifies our curriculum—has always given us maximum accreditation when it makes its required visits. We keep our office hours, and we're available for extra instruction whenever a student needs it. Our standards as a faculty are extremely high. An "A" in a course at the Air Force Academy is really an accomplishment. This has not always been the case elsewhere in higher education.

## The Core

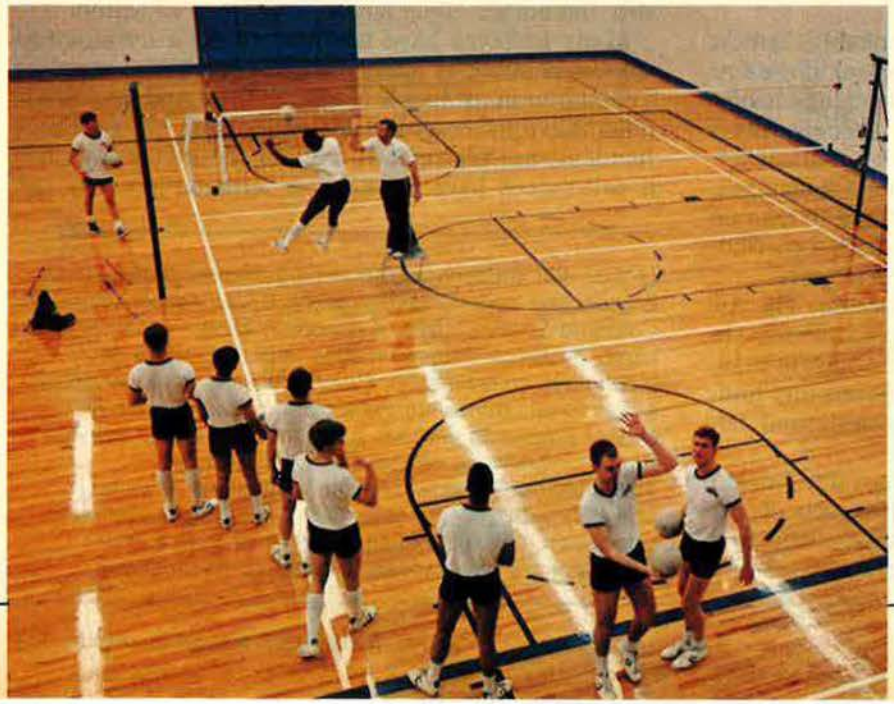
The cornerstone of our curriculum is the "core." The core philosophy was first discussed in 1948 by a planning board made up of military professionals and noted American educators. It has been with us from the very beginning, so the thirtieth anniversary of the Air Force Academy is the thirtieth anniversary of the core as well.

Many colleges and universities around the country are reexamining the idea of a core curriculum, and when they see the results of the Academy's core, they become even more serious about adopting one. Several years ago, as a matter of fact, Harvard adopted a core philosophy, and since then a score of others has done the same.

Our core comprises 111 semester hours that absolutely every cadet must take. It is roughly divided between the basic and engineering sciences on the one hand and the social sciences and humanities on the other. Thus, each student at the Academy receives a solid foundation not only in the basic physical laws of the universe but also in the incredibly powerful ideas of poets, philosophers, and great social thinkers.

Once cadets advance in the core, they can select from among twenty-three majors that range from electrical engineering and astronautics to history and political science. The idea here, though, is not necessarily to become an electrical engineer but to master the skills necessary to meet the tremendous technological and political challenges facing an Air Force officer. Our graduates *must* be able to deal with a wide range of responsibilities.

Modern institutions of higher education usually do not, of course, have "sponsors" in the same way that the



***LEFT: Physical education classes are held in the Cadet Gymnasium. ABOVE: C/1C Maureen Moslow, left, and roommate C/1C Kathy Eggert compare notes while preparing the next day's assignment.***


***Instructor Maj. Richard W. Storer, left, and C/3C Christopher Roeder prepare for a glider lesson.***

Academy is sponsored by the Air Force. But modern educational institutions can sculpt their curricula in ways suggested by the Academy's example so that students can graduate as "professionals." It may well be time for other schools to adopt a similar core model that can base students in the humanities and sciences and give them a solid foundation from which to select career majors.

A core, mixed with a solid major, is probably the best method by which a young person can prepare himself or herself for the demands of a constantly changing society. Within the Academy core, for example, students must study such subjects as computer science, political science, electrical engineering, math, foreign languages, and chemistry and physics and are required to take an English course in every academic year. Such a curriculum truly puts students in touch with their times.

And the record attests to the core's success. The Air Force Academy's curriculum has yielded twenty-six Rhodes Scholars since it graduated its first class in 1959, not to mention more than fifty Guggenheims and hundreds of other prestigious academic awards and fellowships.

We're far from being a Rhodes Scholar mill, though. We aim for quality across the board in each of our graduates. We've graduated nearly 16,000 since the first degrees were handed out in 1959, and more than seventy percent of those graduates are still on active duty today. The Academy's cadets go on to be pilots, navigators, scientists, engineers, support officers, astronauts, lawyers, and doctors—but they're all trained to be Air Force officers first and foremost.

### A Philosophy of Looking Ahead

A mark of a strong institution of higher learning is that it can anticipate the needs of its students and the nation in terms of the skills needed to create progress and prosperity. The Academy's curriculum has certainly proven itself in terms of its anticipation of Air Force needs.

For example, since 1965 an astronautics major has given the Academy's cadets an opportunity to prepare themselves for space travel. That major was followed later by a space physics track that offers the same kind of intensive space/science-related study. A soon-to-be-instituted space sciences major will round out the Academy's superb program anticipating the Air Force's future in space.

The Academy is also unique in its ability to bring teachers to the classroom who fly the aircraft and operate the space systems that the cadets study. Astronauts and Space Shuttle crews are frequent visitors to Academy classrooms. Graduates like Col. Karol Bobko and former faculty members like Lt. Col. John Fabian are just two of the many "real-world" people our cadets see and learn from. (Colonel Bobko was the pilot on the five-day flight of Space Shuttle *Challenger* in April 1983; Colonel Fabian flew aboard *Challenger* in June 1983, the next Shuttle flight, as a mission specialist.)

Cadets themselves are given rare opportunities to participate in actual programs. In Project Scenic Fast, for example, six cadets placed experiments on board *Challenger*'s maiden flight last April. The Academy's programs truly put students in touch with their times. At the same time, we anticipate and meet exciting Air Force needs.

The Academy is also anticipating the national need for computer literacy in the twenty-first century. That's a concern I saw everywhere I visited, and it is unquestionably the hottest topic among American educators.

Many colleges have been receiving a tremendous amount of publicity lately because of their plans to place a computer in the hands of each of their students. While others have gotten a good deal of attention, the Air Force Academy has been quietly working toward the day when it will indeed have a computer terminal in every stu-

---

*Lt. Col. Bill Wallisch, USAF, is an associate professor of English and communication at the US Air Force Academy, Colorado Springs, Colo. A nationally known expert on video, technical communication, and the impact of technology on education, Colonel Wallisch has served on a task force counseling the Colorado Commission of Higher Education and has advised the National Science Board Commission on Pre-College Education in Mathematics, Science, and Technology. He is working presently with the Colorado Task Force on Excellence in Education. Colonel Wallisch holds a doctorate in education from the University of Southern California.*

## The Spirit of the Academy

College campuses are usually impressive places, but the campus of the Air Force Academy is certainly one of the most impressive in America. As a matter of fact, it is the number-one tourist attraction in Colorado. Just as one tries to visit the Harvard campus when passing through Boston or Notre Dame's when passing through Indiana, so it is that almost a million tourists visit our grounds each year. The Academy never fails to impress its visitors.

The famous American educational philosopher Robert Maynard Hutchins once said that he loved to stroll about a college or university campus on the eve of a speaking engagement just to get a sense of the "spirit of the place." As I visited scores of campuses last year, I felt the spirit of places like Michigan, Nebraska, William and Mary, and so many other diverse and unique campuses. But my sabbatical away made me see the special spirit of the Academy even more clearly.

In a way, we're typical of most American campuses. We have green spaces, all of the predictable buildings—a library, labs and classrooms, offices, a bookstore, and all of the facilities needed to house and feed a student population. But to pick up on the "spirit of the place" one must examine the difference between the Academy and a typical campus.

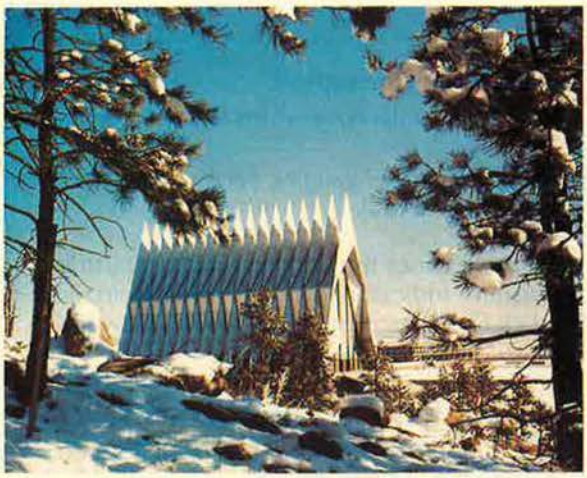
The blue uniform—and the dedication to it—is, of course, the central factor. And though most every campus has a chapel, ours calls forth a special meditative repose—a place where young cadets may contemplate future responsibilities and decisions apart from the bustle of everyday life. Its spires reach skyward toward the high blue, and out on the terrazzo are airplanes reminding cadets of their future and the goal they should all be working toward. Down the road, too, we have a cemetery where Academy graduates and Air Force heroes lie at rest, reminding cadets that the stakes are high and the commitment very deep.

Everywhere you go on the Air Force Academy campus you find people who are dedicated to the mission of graduating superb career officers. Like any other campus, we have hundreds and hundreds of people who support the educational and training mission. But one wonders if you could ever find such dedication in the people who support other educational institutions. In truth, everyone at the Academy is a professor, and all are role models. Air Force civilians and Air Force military are all doing their part with remarkable zeal.

And beyond our gates there are Air Force liaison officers and graduates all over the country imbued with that same dedication, working every day on finding new candidates to fill the ranks of the Cadet Wing.

To feel and see and witness all of that is to capture the special spirit of the Academy, a singular institution of American education.

—LT. COL. BILL WALLISCH, USAF



***With its spires reaching skyward, the Academy chapel is "a place where young cadets may contemplate future responsibilities."***

dent's room and a tremendous computer base to serve student, faculty, and administrative needs.

Over the years, the *Chronicle of Higher Education* and other educational publications have been reporting calls by American business for more ethics courses in the American curriculum. At the Air Force Academy, honor and ethics are a way of life. Not only are such subjects built into the core, but the cadet honor code makes the focus on honor an everyday, living thing. Over the years our graduates have demonstrated their commitment to duty and honor. Names like Richter and Sijan signify that commitment. (1st Lt. Karl W. Richter, a member of the Academy class of 1964, was killed in July 1967 after completing 198 missions over North Vietnam as an F-105 pilot; Capt. Lance P. Sijan was the first Air Force Academy graduate to receive the Medal of Honor; after his F-4C was disabled, he parachuted into enemy territory and avoided capture for six weeks, but died, January 1968, while a POW.)

Athletics is also built into the program. At the Air Force Academy, each cadet is a true scholar-athlete whether or not he or she plays varsity sports.

And nowhere in American higher education is there anything like the professional military training that cadets receive here. One would naturally expect to see military training at a service academy, but the depth of that program far exceeds anything a casual observer might expect. It's so much more than a mere regimen of military courtesies and traditions. Our young people receive *practical* leadership training in a carefully constructed leadership laboratory. At the Academy, the idea of asking more from students is *entirely* appropriate.

### The Four Pillars

It is impossible to talk about the success of the Air Force Academy program strictly in terms of the academic curriculum. A wider view explains better why the program is so effective. Our Superintendent, Lt. Gen. Winfield W. Scott, Jr., put it best when he said that our program rests on four strong pillars: military, academic, athletic, and spiritual.

The core curriculum, of course, falls under the Dean of the Faculty. The superb military training is the responsibility of the Commandant of Cadets. The Director of Athletics, of course, sees to it that cadets have the sound bodies they need not only to meet the rigors of our program but also to prepare themselves for future demands. The spiritual aspect can be found in every area and is perhaps the extra dimension that traditional learning might have overlooked in recent years. When I brief other educators on that total concept—the four pillars—they are always impressed.

A statue on the terrazzo of the Academy has this inscription: "Man's flight through life is sustained by the power of his knowledge." So it is that the curriculum of the Academy is the power that sustains its professional graduates in all manner of challenges.

I think that our program at the Academy is an admirable example for the entire American educational community. In only thirty years we've chalked up a record worth looking at. ■

# Reduce life cycle costs with one single part number for all tanks. From Smiths Industries.

- **Automatic identification:** aircraft and tank.
- **Low fuel warning:** visual and discrete.
- **Automatic calibration:** both zero and full.
- **Now in service.**


2100 Series, actual size, with automatic calibration and full scale adjust, for interchangeability in all positions.




2300, similar to 2100 Series, but with a graphic indication of fuel weight in addition to the LCD display.

**Smiths Industries Fuel Quantity Indicators promise reduced maintenance costs, lower operating costs, and optimized logistics costs associated with these features:**

- Comprehensive system diagnosis with multiple error code displays including faulty wiring, tank or probe contamination, line failures, and others.
- Designed to meet the military environment, hermetically sealed, explosion proof, can be used in hazardous areas.
- Easily retrofitted, compatible with existing wiring, connectors, tank probes, and compensator units.
- Integral volumetric top-off.
- Digital communications which eliminate system error.
- Most accurate fuel gauging yet — solid state or electro-mechanical.

To learn more about the benefits Smiths Industries Fuel Quantity Indicators promise military aircraft, call Chuck Gunderson at (813) 513-7781 or write:

**SMITHS INDUSTRIES**
AEROSPACE & DEFENSE SYSTEMS INC.

**Clearwater Division, 14180 Roosevelt Boulevard, Clearwater, FL 33518 U.S.A.**

LOS ANGELES (213) 823-5497 • SEATTLE (206) 451-9099 • MALVERN, PA (215) 296-5000 • CHELTENHAM, UK (024267) 3333

THE prospect of a PCS move unsettles the military family. From initial PCS notification, usually no less than ninety days before reporting date, apprehension builds. The children dread the loss of friends and worry about new schools. A spouse may regret having to give up a job and wonder briefly (and without hope) if the drapes will fit the new windows. The military member's attention, at first, will probably focus on the new job. But ultimately concern shifts to the process of the move.

How to schedule the movers to minimize the time between houses? Where will the family live temporarily? If they own a home, will they sell and buy again at the new location? If renters, will they rent again, try for housing on base, or shop to buy?

### Reduction in PCS Moves

Over the last decade, the Air Force has made significant progress in reducing the number of PCS moves each year, both per capita and in sheer numbers. In 1974, there were 644,000 moves. By contrast, Air Force officials estimate there will be 296,000 moves this year. As a result, average time on station has doubled in the past ten years. Discounting those moves associated with someone entering or leaving the service or attending training, a member can now expect to be on station forty-nine months instead of an average of about twenty-four months in 1974.

Policy changes and incentive programs are responsible for the longer average time on station. While some measures were introduced because of congressional mandates, others resulted from Air Force recognition of the tremendous cost in dollars and personnel turbulence caused by too-frequent moves.

The Air Force says that ninety percent of PCS moves are caused by factors beyond its control—a retirement, a separation, or the end of an overseas tour. For example, four PCS moves are caused when one aircraft maintenance specialist in USAFE separates from the service (his or her return to the United States, the move of a replacement, the move of a recruit to active duty, and the subsequent move for training). Further substantial reductions in PCS moves cannot be made, the Air Force says, without a concurrent reduction in mission.

Nevertheless, Congress is expected to maintain FY '85 PCS funding at last year's level—in effect, reducing PCS funding because of inflation. Assuming that mission requirements continue to be met, the Air Force will have to make up the difference from the ten percent of PCS moves over which it has control. Base-of-preference, join spouse, and some training programs might be slowed or curtailed and tours extended.

The sentiment in Congress and the Defense Department seems to be that the Air Force has done a good job in reducing moves but that additional trims are still needed. Despite the reduction by fifty-four percent in PCS moves over the decade, PCS costs have increased. Led by household-goods moving and storage bills, the cost of the average move has tripled in the last ten years.

Dr. Lawrence J. Korb, Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics (MRA&L), says that the frequency of PCS moves is sometimes exaggerated: "How many retirement parties have you been to," he asked, "where they give an award to the wife and say, 'Here's Jane So-and-So who has moved twenty-seven times in twenty years'? That gets over on the Hill and they cut our PCS money. We've got to do a better job." Air Force officials note that the average Air Force member moves only seven or eight times over a career.

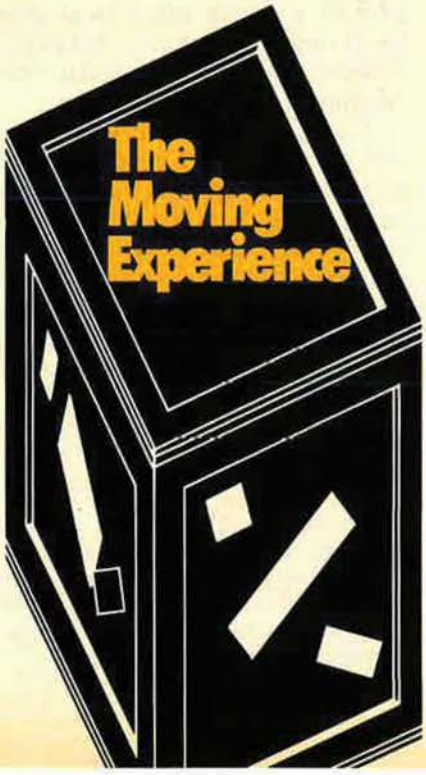
### The Reimbursement Gap

Although compensation varies according to the Air Force member's grade and the type of PCS move, basic reimbursements are:

- Packing, transport, and delivery of household goods.
- Per diem of $50 for member during travel (only $45 for enlisted members because Congress has imposed a $5 decrement on enlisted per diem).
- Mileage allowance of thirteen cents per mile for service member, seven cents for each dependent age twelve and older, and 3.5 cents for dependents ages two through eleven.
- Dislocation allowance (one month's basic allowance for quarters—BAQ).
- Mobile home movement (in lieu of shipment of household goods and subject to a maximum cutoff).
- Car-to-port dropoff and pickup allowance of sixteen cents per mile, one way, for those entitled to ship a car overseas.
- Space-available air transporta-

**BY LT. COL. ROBERT W. NICHOLSON, USAF**

Average time on station is longer these days, but USAF members still average seven or eight moves in a career—and still lose money.



tion for member only to new area for house hunting (permissive TDY, no reimbursement).

- Temporary lodging allowance upon arrival and departure from overseas bases. The sixty-day maximum of entitlement may be extended for extraordinary reasons, such as nondelivery of household goods.

It's no secret to Air Force members that Uncle Sam isn't the only one who pays moving bills. A large part of the expense is "absorbed" by the military member as well.

**Out-of-Pocket PCS Expenses***

| | All Respondents | Officers | Enlisted |
|---|---|---|---|
| Total Expenses | $1,978 | $3,222 | $1,651 |
| Paid Out of Pocket | $1,519 | $2,419 | $1,275 |
| Reimbursed | $ 459 | $ 803 | $ 376 |
| Percentage Reimbursed | 23% | 25% | 23% |

*Median figures

To get a handle on how much PCS moves were costing Air Force members, the Air Force Manpower and Personnel Center began conducting annual surveys in 1982. A random sampling of blue-suiters who moved that year detailed expenses before, during, and after a move. The survey was repeated in 1983 and pulled in 3,261 responses. About half of the respondents were officers, half enlisted members, and three-fourths were married.

The startling finding was that, exclusive of home ownership costs, the military member was reimbursed *only $1 for every $4* spent out of pocket in connection with a move *(see chart)*. The respondents reported that the biggest expenses before their moves were for housecleaning and meals; during the move for gas, lodging, and meals; and after the move for moving-in preparations and meals. Nearly sixty percent said they had to borrow money or dip into savings accounts to cover expenses. One-third took house-hunting trips at a median cost of $299. Almost ninety percent of respondents needed temporary lodging and ran up bills as high as $894 for senior enlisted members and $746 for officers.

Among the indirect costs of PCS moves were the incomes lost from a spouse's job or a member's second job. One-third of respondents reported a median loss of $588 per month because a spouse quit to move; eleven percent said they themselves gave up second jobs that brought in a median salary of $290 per month.

### Homeowners Hardest Hit

Hardest hit in a PCS move were homeowners, according to the survey findings. The average home purchase price increased from $75,000 to $85,000 in 1983, although a decline in interest rates from 13.5 percent (1982) to 12.5 percent (1983) softened the blow. Median costs borne by home sellers were $5,200 (principally for realtor fees), and median costs for home buyers were $7,625 (closing, utility deposits, and required down payments).

Careful record-keeping may help a military mover recoup some losses at tax time. Expenses exceeding reimbursements may be reported on federal income tax returns as an adjustment to income, rather than as a deduction. The moving expense adjustment may be claimed whether a taxpayer itemizes or takes the standard deduction.

Government civil servants who relocate enjoy more generous compensation for expenses than do military people. And the Ninety-seventh Congress took action to increase civilian household-goods (HHG) weight allowances, the period of temporary lodging allowance, and reimbursement for real-estate expenses.

Specifically, civilian advantages include:

- An HHG weight allowance of 13,500 pounds, regardless of grade. (There is a request in the 1985 budget to raise that limit to 18,000.)
- House-hunting trip—paid transportation and per diem for employee and spouse.
- A fifteen-cent mileage allowance.
- Real-estate expense reimbursement up to $22,500 if the employee is a homeowner. (That maximum will increase annually at the same rate as the housing component of the Consumer Price Index.)
- Per diem for employee and dependents during travel.
- Temporary quarters allowance for sixty days, which may be extended for an additional sixty days.
- Miscellaneous expense reimbursement up to $700 for appliance hook-ups, cutting and fitting rugs and drapes, nonrefundable utility fees, etc.

The 1984 Continuing Appropriations Act also provides for the repayment of any taxes due on reimbursements and permits government agencies to contract with private relocation firms to plan a civilian employee's move. Despite these and other improvements provided by the Act, compensation paid civilian employees still lags behind that paid private-sector employees.

### Comparing Compensation

In a working paper presented to DoD and Congress, Air Force military personnel officials compared the reimbursements of a GS-9 and a master sergeant moving this year from Washington, D. C., to San Francisco, Calif. Assuming each had three dependents, took house-hunting trips, bought and sold homes, and lived in temporary quarters for sixty days, the sergeant would be reimbursed about $1,600 while the civilian employee could be paid $20,000 or more, depending on real-estate expenses.

But personnel officials say that a straight comparison of relocation compensation is inappropriate for a

---

*Lt. Col. Robert W. Nicholson, USAF, is an Air Force public affairs officer who writes for* Air Force *Magazine regularly. His most recent offerings have been "In the Footsteps of Giants" in the October '83 issue and "The Word-Processing Revolution" in February '84. He is the coauthor of* The Language of National Defense, *a primer on the structure of the US defense establishment, published by Regents, New York, in 1976.*

number of reasons. Among them are:

- Civilian-employee moves are infrequent and unusual, while military members know they will move every few years. Only an estimated 2,000 Air Force civilian employees will move this year at government expense. Uniformed members will make 296,000 moves. Frequent moves are not part of the "implied contract" of most civil servants, but they are for service members.
- Civilian moves are reimbursed only when made for the convenience of the government. Many civilian moves are not funded because they are made for the employee's convenience.
- Since they do not expect to move as part of their jobs, most civilians sink deeper roots. They buy homes not as short-term investments but as permanent residences.

### PCS Improvements?

Congress recognizes that military members lose money on a PCS move, but blames the situation on the way the compensation system has evolved. Despite this recognition, Congress shows little inclination to favor major improvements to PCS entitlements.

First, no one has presented conclusive proof to lawmakers that insufficient PCS compensation causes significant recruiting or retention problems. Second, congressional committee staffers repeatedly cite recent General Accounting Office and Congressional Budget Office studies that found that the average total military compensation package is superior to its civilian and Civil Service counterparts. "Sure, I think compensation for moving should be increased," said one Hill staffer, "but I also believe the total package shouldn't grow, so tell me, which other entitlement can be cut?"

Because of the number of moves each year, the cost of any increase in PCS compensation would be "astronomical." Sympathy in Congress for increasing compensation "goes out the window when anyone quotes dollar figures," another staff member said. Congress is wary of establishing *any* new entitlements because they are so difficult to cancel when they have outlived their justification.

Among the many PCS compensation improvements sought by the Air Force, only an increase in mileage allowance and a new allowance for temporary lodging and meals enjoy any support on the Hill this year. The DoD FY '85 budget requests an increase in mileage allowance from thirteen to fifteen cents and a HHG weight allowance increase for E-7s and above; also requested is a raise of the HHG weight limitation from 13,500 pounds to 18,000 pounds. Authority is also sought to begin a Temporary Lodging Entitlement program authorized by law in 1981. TLE would, if ever funded, provide a maximum payment of $110 per family per day to cover costs of meals and lodgings during a move.

### The IRS's Assault

Annual housing surveys indicate that about forty percent of the Air Force's 350,000 families occupy government quarters, while the remainder rent or buy homes. The number of Air Force homeowners, service-wide, is estimated at between seventeen percent and twenty percent. Looking only at Air Force families living in the contiguous United States, about twenty-two percent are homeowners. Counting only those families living off base in the US, about thirty-five percent are buying and sixty-five percent are renting. It remains to be seen whether increased pay and allowances over the past few years, combined with less severe mortgage interest rates, will encourage more Air Force members to buy instead of renting or living on base.

One dark cloud on the prospective homeowner's horizon is a possible move to limit deductions for mortgage interest and property tax. The tax code disallows any deduction for "expenses allocable to tax-exempt income" and, in a 1983 ruling resulting from a tax court case, this was interpreted to mean that a minister could not deduct interest and taxes if those were paid with a tax-free parsonage allowance.

If this ruling were applied to military compensation, BAQ and VHA might be considered tax-exempt income in the eyes of IRS, which would then disallow any portion of a home mortgage interest deduction attributable to that income. *(See "A Grotesque Notion," February '84 issue, p. 4.)*

An adverse ruling would have "a disastrous effect on military homeowners," said Maj. Gen. Robert C. Oaks, Air Force Director of Personnel Plans. DoD sources claim that income taxes for 270,000 service members would increase by $800 to $4,000 a year—the equivalent of a four percent to nine percent pay cut. They also predicted increased competition for base housing and depression in some housing markets, especially in small towns with large military populations.

Raising BAQ could solve the problem, but it would be expensive since the increases would go to renters and buyers alike. Because of the cost, a BAQ raise is unlikely.

### How VHA Works

There are other dark clouds on the military homeowner's horizon as well. For instance, most members not living in government quarters in the CONUS draw both BAQ and a supplementary Variable Housing Allowance. Since VHA is significantly different from one part of the country to another, those preparing to move are well advised to plan housing decisions with knowledge of their future combined BAQ/VHA entitlements. But recent developments in the VHA program make such planning a little more difficult. To understand why requires an understanding of the program's origin and its relationship to BAQ.

The last time BAQ was adjusted for comparability with actual housing costs was in 1971. Since then, BAQ has increased in fits and starts, usually by the same percentage as basic pay increases. Those increases, however, have not kept BAQ on par with the housing market: While BAQ has roughly doubled since 1971, median rents have almost tripled and home values have more than tripled. In high-cost areas of the country, the disparity between housing costs and compensation was felt most sorely.

Recognizing this inequity and wishing to avoid penalizing military families because of where they were sent, Congress enacted a statute in 1980 that provided for payment of a Variable Housing Allowance in those locations where the average housing costs—rent (or rental

equivalent for homeowners) plus utility and maintenance costs—exceeded 115 percent of BAQ. Average area housing costs, by grade, are established through a survey conducted each spring by the DoD Per Diem Committee.

Two congressional actions have since limited VHA payments. In FY '83, Congress required members to absorb about 120 percent instead of 115 percent of local housing costs before VHA was computed. And in FY '84, Congress, at the request of DoD, froze total housing allowances at the previous year's levels by requiring a dollar-for-dollar reduction in VHA equal to the four percent increase in BAQ that was effective January 1, 1984. Congress considered both actions expedient if unpleasant ways to cut the defense budget. The combined effect of these actions is that today service members are absorbing 130 percent of their housing costs instead of 115 percent—a loss per person averaging $1,100 per year.

Not everyone's total for BAQ and VHA is frozen at last year's level, however. Some members are being paid *less*. The 1984 appropriation limited the combined BAQ/VHA entitlement to $800 for those with dependents and to $600 for single members. Air Force officials call this ceiling an unwarranted penalty for those assigned to the highest cost areas that perpetuates the very inequity VHA was designed to correct. About 1,800 senior officers within the Defense Department are affected. This year, their housing allowances will be as much as $1,500 less than they received last year.

### Reexamining VHA

Why the reversal on the Hill? Besides growing concern over the $200 billion budget deficit, lawmakers were confronted by what they perceive to be a tripling of VHA entitlements over expected costs. According to Dr. Korb, Congress is shocked that VHA is paid in ninety-eight percent of duty areas in the United States instead of the handful of selected high-cost areas they thought would be affected. When the program was presented in 1980, DoD estimated costs to be about $350 million (Air Force estimates were $600 million); today's program would be about $1 billion but for congressionally imposed ceilings.

Since VHA is payable only in an area where average housing costs exceed 115 percent of BAQ, the high percentage of VHA-eligible areas indicates that BAQ rates are woefully outdated. Air Force sources say they warned Congress in 1980 that because BAQ rates were out of kilter with the marketplace, large numbers of people would be instantly eligible for VHA. In 1981, the first year the allowance was paid, ninety-six percent of service members drawing BAQ in the CONUS also drew VHA.

The Senate Armed Services Committee and Senate Appropriations Committee directed the preparation of a report reexamining VHA to determine its continued usefulness and whether changes are warranted either to entitlements or the way they are administered. The Appropriations Committee specifically directed that the report consider "the need for VHA payment to senior officer personnel, introduction of higher absorption factors, total elimination of the program, redefinition of high-cost areas, creation of a new rate structure, and other possible measures to control costs."

The Air Force chaired a triservice study group that prepared a report for DoD's use in responding to Congress by March 1, 1984.

Explaining VHA's growth, the Air Force cited three reasons:

- Since BAQ had not kept pace with actual costs, more VHA money is needed to make up the difference.
- Service members with more money to spend upgraded from substandard to more commodious quarters, increasing the average costs.
- Improvements in survey methodology over the last two years reflected actual housing costs more accurately.

Congressional critics who feel the program is out of hand have other explanations. They express doubts about the validity of survey data gathered from those who stand to gain by inflating their housing costs. And they seem convinced that the principal beneficiaries of VHA are not enlisted members who can now afford decent housing but senior officers who can upgrade from modest to luxurious quarters.

The FY '85 Defense budget requests $1.1 billion for VHA. The request is a $137 million (or fourteen percent) increase over the FY '84 appropriation and seeks no adjustment to BAQ beyond the 5.5 percent across-the-board pay increase also requested. The VHA request assumes the present $800/$600 ceiling will not be continued.

### Sweeping Changes Unlikely

The attention given pay and compensation issues—including that given PCS moves and housing—is based in large part on the success of the armed forces in attracting and retaining good people. Today, the services enjoy the best recruiting and retention rates in history. Many observers are convinced, however, that those rates will decline as the economy picks up and as competition for skilled manpower increases.

What will happen to the military compensation package if that happens? While congressional sources admit there may be "some tweaking" in the 1985 budget—for example, a pay raise less than the 5.5 percent requested by DoD—there is a determination to maintain comparability. No one, it seems, wants to repeat the experience of the late 1970s when skilled people left the services in droves.

No one would argue that compensation for members with families has not improved. It has improved significantly. Service members now enjoy a series of entitlements designed to lessen the financial impact of moving and of maintaining a household. By fighting to establish these entitlements, the services have made it clear that their intent is to foster and encourage military families, and Congress has supported that objective by appropriating money to fund the programs.

But has Congress done enough? The consensus on the Hill is that while there are shortcomings in the levels of entitlement for moving, establishing, and maintaining a household, they are offset by other features of the Air Force member's total compensation package.

The immediate forecast for improvements, then, is that while adjustments to certain allowances are likely, sweeping changes are not. ■

# The longer a missile needs auxiliary power, the more it needs ours.

Longer missions and longer shelf life.

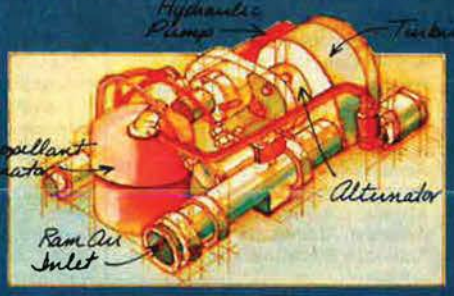
These are the demands that face today's sophisticated missiles. Demands that call for turbine auxiliary power from Garrett. The same auxiliary power that's already found applications on such missiles as Pershing, Trident, and ASALM.

Compared to battery systems of the same size and weight, a Garrett turbine power system offers higher power density and output over the entire mission duration — regardless of whether the output is hydraulic, electric, or a combination of both.

When it comes to meeting today's longer 15-year shelf life requirements, the comparison is even more dramatic. Only turbine auxiliary power assures constant launch readiness, remains unaffected by extremely low temperatures, and withstands high G-forces, shock, and vibration.

Turbine auxiliary power from Garrett also gives designers a freer hand. Multiple voltage outputs are easily supplied with a single alternator plus electronic power conditioning. Even growth in power level is easily accomplished without significant increases in size or weight.

Yet, for all its advantages, Garrett's turbine auxiliary power system is a proven, low-risk approach. Existing designs of centrifugal, gear and piston pumps are utilized for turbo-hydraulic output, while our turbo alternators and electro-mechanical actuators are based




on samarium-cobalt designs now in production.

Interested in finding out exactly what single type of power system — or combination of types — is optimal for your missile's particular mission? Garrett experts are ready now to provide you with a comprehensive tradeoff analysis.

Contact: Missile System Sales, AiResearch Manufacturing Company, 2525 West 190th Street, Torrance, CA 90509 (213) 512-2914.

**GARRETT**

GARRETT The Garrett Corporation
One of The Signal Companies

# INDUSTRIAL ASSOCIATES OF THE AIR FORCE ASSOCIATION

## "PARTNERS IN AEROSPACE POWER"

Listed below are the Industrial Associates of the Air Force Association. Through this affiliation, these companies support the objectives of AFA as they relate to the responsible use of aerospace technology for the betterment of society, and the maintenance of adequate aerospace power as a requisite of national security and international amity.

ABA Industries, Inc.
Acurex Corp.
Advanced Technology Div. of Tritronics, Inc.
Aero Energy Systems, Inc.
Aerojet ElectroSystems Co.
Aerojet-General Corp.
Aerojet Ordnance Co.
Aerojet Strategic Propulsion Co.
Aerojet TechSystems Co.
Aerospace Corp.
Aerospatiale, Inc.
Aircraft Porous Media, Inc.
Alkan U.S.A., Inc.
American Airlines Training Corp.
American Electronic Laboratories, Inc.
Amex Systems, Inc.
Analytic Services Inc. (ANSER)
Anheuser-Busch, Inc.
Arco Engineering Co.
Aris Engineering Corp.
Aster Engineering Corp.
Astronautics Corp. of America
AT&T Information Systems
AT&T Long Lines Department
Avco Corp.
Battelle Memorial Institute
BDM Corp., The
Beech Aircraft Corp.
Bell Aerospace Textron
Bell Helicopter Textron
Bell & Howell Co.
Bendix Corp.
Benham Group, The
Boeing Co., The
British Aerospace, Inc.
British Aerospace Dynamics Group
Brunswick Corp., Defense Div.
Budd Co., The
CAI, A Division of Recon/Optical, Inc.
California Microwave, Inc., Communication Systems Operation
Calspan Corp., Advanced Technology Center
Canadair, Inc.
Canadian Marconi Co.
Cessna Aircraft Co.
Chamberlain Manufacturing Corp.
Clearprint Paper Co., Inc.
Clifton Precision, Instruments & Life Support Div.
Colt Industries, Inc.
Computer Sciences Corp.
Comtech Government Systems Div.
Conrac Corp.
Continental Page Engineers, Inc.
Control Data Corp.
Cryomec, Inc.
Cubic Corp.
Cypress International, Inc.
Data General Corp.
Decisions and Designs, Inc.
Dowty Aerospace & Defense Div.
Durakon, Inc.
Dynalectron Corp.
Eastman Kodak Co.
Eaton Associates, Inc.
Eaton Corp., AIL Div.
ECI Div., E-Systems, Inc.
EDO Corp., Government Systems Div.
Educational Computer Corp.
E. I. du Pont de Nemours & Co.
Emerson Electric Co.
E-Systems, Inc.
Euromissile
Ex-Cell-O Corp., Aerospace Div.
Fairchild Industries, Inc.
Fairchild Weston Systems, Inc.
Falcon Jet Corp.
Ford Aerospace & Communications Corp.
GA Technologies, Inc.
Garrett Corp., The
Gates Learjet Corp.
General Dynamics Corp.
General Dynamics, Electronics Div.
General Dynamics, Fort Worth Div.
General Electric Co.
GE Aircraft Engine Group
GMC, Delco Systems Operations
GMC, Detroit Diesel Allison Div.
Goodyear Aerospace Corp.
Gould Inc., Computer Systems Div.
Gould Inc., Defense Systems Group
Grumman Aerospace Corp.
Grumman Data Systems Corp.
GTE Communications Products Corp., Communications Systems Div.
GTE Products Corp., Sylvania Systems Group
Gulfstream Aerospace Corp.
Hamilton Technology, Inc.
Harris Government Communications Group
Harris Government Support Systems Div.
Harris Government Systems Sector
Hayes International Corp.
Hazeltine Corp.
Hercules Aerospace Div.
Honeycomb Co. of America, Inc.
Honeywell, Inc., Aerospace & Defense Group
Honeywell, Inc., Precision Weapons Systems Div.
Howell Instruments, Inc.
HR Textron, Inc.
Hughes Aircraft Co.
IBM Corp., Federal Systems Div.
IBM National Accounts Div.
Information Systems & Networks Corp.
Intermetrics, Inc.
Interstate Electronics Corp.
Israel Aircraft Industries Int'l, Inc.
Itek Optical Systems, A Division of Litton Industries
ITT Defense Communications Div.
ITT Defense-Space Group
ITT Federal Electric Corp.
Jane's
Kelsey-Hayes Co.
King Radio Corp.
Kollsman Instrument Co.
Lear Siegler, Inc.
Lewis Engineering Co., Inc.
Litton Aero Products Div.
Litton-Amecom
Litton, Applied Technology Div.
Litton Data Systems
Litton Industries
Litton Industries Guidance & Control Systems Div.
Lockheed Corp.
Lockheed Aircraft Service Co.
Lockheed California Co.
Lockheed Electronics Co.
Lockheed Engineering & Management Services Co., Inc.
Lockheed Georgia Co.
Lockheed Missiles & Space Co.
Logicon, Inc.
Loral Corp.
LTV Aerospace & Defense Co.
Lucas Industries Inc.
Magnavox Government & Industrial Electronics Co.
M.A.N. Truck & Bus Corp.
Marconi Avionics, Inc.
Marquardt Co., The
Martin Marietta Aerospace
Martin Marietta Denver Aerospace
Martin Marietta Orlando Aerospace
MBB
McDonnell Douglas Corp.
Midland-Ross Corp./Grimes Div.
MITRE Corp., The
Moog, Inc.
Morton Thiokol, Inc.
Motorola, Inc., Government Electronics Div.
NORDAM
Northrop Corp.
Northrop Corp., Aircraft Div.
Odetics, Inc.
OEA, Inc.
O. Miller Associates
Orbital Sciences Corp.
Oshkosh Truck Corp.
Over-Lowe Co.
Pacific Car and Foundry Co.
Pan Am World Services, Inc., Aerospace Services Div.
Planning Research Corp.
Products Research & Chemical Corp.
Rand Corp.
Raytheon Co.
RCA, Government Systems Div.
Rediffusion Simulation, Inc.
Republic Electronics, Inc.
Rockwell Int'l Corp.
Rockwell Int'l, Collins Government Avionics Div.
Rockwell Int'l Defense Electronics Operations
Rockwell Int'l North American Aircraft Operations
Rockwell Int'l North American Space Operations
Rockwell Int'l Rocketdyne Div.
Rohr Industries, Inc.
Rolls-Royce, Inc.
ROLM Corp., Mil-Spec Computers Div.
Rosemount Inc.
Sabreliner Corp.
Sanders Associates, Inc.
Science Applications, Inc.
Short Brothers USA, Inc.
Sierra Research Corp.
Simmonds Precision
Singer Co., The
Smiths Industries, Aerospace & Defence Systems Co.
Space Applications Corp.
Space Communications Co.
Space Ordnance Systems
Sperry Corp.
SRS Industries, Inc.
Standard Manufacturing Co., Inc.
Stencel Aero Engineering Corp.
Sundstrand Corp.
Sverdrup Corp.
Syscon Co.
System Development Corp., A Burroughs Co.
Systems Control Technology, Inc.
Systron Donner, Safety Systems Div.
Tandem Computers Inc.
Teledyne, Inc.
Teledyne CAE
Teledyne Ryan Aeronautical
Texas Instruments Inc.
Thomson-CSF, Inc.
Tracor, Inc.
TRW Space & Technology Group
Turbomach Div. of Solar Turbines, Inc.
United Technologies Corp.
UTC, Chemical Systems Div.
UTC, Hamilton Standard Div.
UTC, Norden Systems, Inc.
UTC, Pratt & Whitney Aircraft Group
UTC, Research Center
UTC, Sikorsky Aircraft Div.
United Telecommunications, Inc.
Varo, Inc.
Vega Precision Laboratories
Watkins-Johnson Co.
Western Electric Co., Inc.
Western Gear Corp.
Western Union Telegraph Co., Government Systems Div.
Westinghouse Electric Corp.
Wild Heerbrugg Instruments, Inc.
Williams International
Wyman-Gordon Co.
Xerox Corp.

# JANE'S

## ALL THE WORLD'S AIRCRAFT SUPPLEMENT

# APRIL 1984


**Dornier 228-200 for Malaysia Air Charter**

### DORNIER

*DORNIER GmbH; Postfach 1420, Friedrichshafen/ Bodensee, Federal Republic of Germany*

#### DORNIER 228

Under this general designation, Dornier is marketing two utility and commuter aircraft, as follows:

**Dornier 228-100.** Basic version, with the Dornier new technology (TNT) wing, Garrett turboprop power plant, and accommodation for 15 passengers in standard airline seats at 76 cm (30 in) pitch. Suitable for a wide range of other duties, including freight or mixed cargo/passenger transport, executive travel, air taxi service, maritime surveillance (with undernose search radar), photogrammetry, airways calibration, training, ambulance or search and rescue operations, and paramilitary missions. Main fuselage segments, cabin door, and cockpit equipment standardised with those of Dornier 128.

**Dornier 228-200.** Lengthened fuselage, providing accommodation for 19 passengers at 76 cm (30 in) seat pitch and a larger rear baggage compartment, but otherwise generally similar to 228-100.

The design of these aircraft was formulated to comply with US FAR Pt 23 requirements, including Amendment 23, and Appendix A of FAR Pt 135. One prototype of each version was built; the first of these, the Dornier 228-100 (D-IFNS), made its first flight on 28 March 1981. The 228-200 (D-ICDO) flew for the first time on 9 May 1981. A static test airframe of the 228-200 was also completed. LBA certification of the 228-100 was gained on 18 December 1981, and the first delivery, to AS Norving Flyservice at Kirkenes, Norway, was made in February 1982. This company, which in early 1983 had received two of the three aircraft that it has on order, began scheduled services in the late Summer of 1982. LBA certification of the 228-200 was gained on 7 September 1982 and initial deliveries were made shortly afterwards.

One Dornier 228-100 (D-IAWI), named *Polar 2*,


**Dornier 228-100 specially equipped for Alfred Wegener Institut für Polarforschung (AWI)**

**This photograph of the Dornier 228-200 shows well the distinctive shape of its new technology wings**

has been specially equipped to support a German Antarctic expedition which departed in December 1983. Already tested successfully in Greenland, with a ski-equipped Dornier 128-6, it is fitted with wheel-ski landing gear, ice measuring radar to explore ice gorges and for large area subsoil measurements, a magnetometer to measure anomalies in the Earth's magnetic field, and a special camera for photographic study of the edge of the ice shelf.

Two further versions, known as the **Dornier 228 Maritime Patrol A and B,** have been developed and are described separately. Equipment for a version to support oil pollution location and dispersal is under development.

TYPE: Twin-turboprop light transport.

WINGS: Cantilever high-wing monoplane, comprising two-spar rectangular centre-section and two tapered outer panels ending in raked tips. Dornier Do A-5 supercritical wing section. No dihedral or anhedral. Sweepback on leading-edge of outer panels 8°. Wing leading-edge and raked wingtips of glassfibre/Kevlar composites. Fowler single-slotted trailing-edge flaps and ailerons of carbonfibre composites. Ailerons can be drooped symmetrically to augment trailing-edge flaps, and are operated differentially to serve as conventional ailerons. Remainder of wing of light alloy construction.

FUSELAGE: Conventional stressed skin unpressurised structure of light alloy, built in five sections. Glassfibre nose- and tailcones.

TAIL UNIT: Cantilever all-metal structure, with rudder and horizontal surfaces partly Eonnex covered. All-moving tailplane, with horn balanced elevators. Trim tab in rudder.

LANDING GEAR: Retractable tricycle type, with single wheel on each unit. Main units retract forward and inward into fairings built on to the lower fuselage. Hydraulically steerable nosewheel retracts forward. Goodyear wheels and tyres, size 8.50-10 on mainwheels (12 ply rating on 228-100, 10 ply rating on 228-200); size 6.00-6, 6 ply rating, on nosewheel. Low pressure tyres optional. Goodyear brakes on mainwheels.

POWER PLANT: Two 533 kW (715 shp) Garrett TPE331-5-252D turboprop engines, each driving a Hartzell HC-B4TN-5ML/LT10574 four-blade constant-speed fully-feathering reversible-pitch metal propeller. The Pratt & Whitney Aircraft of Canada PT6A-135 may become available as an optional power plant at a later date. Primary wing box forms an integral fuel tank.

ACCOMMODATION: Crew of two, and 15 or 19 passengers as described under model listings (20 passengers in -200 for Taiwan). Pilots' seats adjustable fore and aft. Individual seats down each side of the cabin with a central aisle. Combined two-section passenger and freight door, with integral steps, on port side of cabin at rear. One emergency exit on port side of cabin, two on starboard side. Baggage compartment at rear of cabin accessible from cabin. Additional baggage space in fuselage nose. Modular units for rapid changes of role.

SYSTEMS: Entire accommodation heated and ventilated. Air-conditioning system optional. Heating by engine bleed air. Hydraulic system, pressure 207 bars (3,000 lb/sq in), for landing gear, brakes, and nosewheel steering. Handpump for emergency landing gear extension. Primary 28V DC electrical system, supplied by two 28V 250A engine-driven starter/generators and two 24V 25Ah nickel-cadmium batteries. Two 350VA inverters supply 115/26V 400Hz AC system. Air intake anti-icing standard. De-icing system optional for wing and tail unit leading-edges, windscreen, and propellers.

AVIONICS AND EQUIPMENT: Instrumentation for IFR flight standard. Standard avionics include dual King KY-196 VHF com, KN-53 VOR/ILS and KN-72 VOR/LOC converters; single KMR-675 marker beacon receiver, KR-87 ADF and KT-76A transponder; Aeronetics 7137 RMI; two Sperry GH14B gyro horizons; two King KPI-552 HSIs; Becker audio selector and intercom. Standard equipment includes complete internal and external lighting, hand fire extinguisher, first aid kit, gust control locks and tiedown kit. Wide range of optional avionics and equipment available.

DIMENSIONS, EXTERNAL:

| | |
|---|---|
| Wing span | 16.97 m (55 ft 8 in) |
| Wing aspect ratio | 9.0 |
| Length overall: | |
| 228-100 | 15.04 m (49 ft 4⅛ in) |
| 228-200 | 16.56 m (54 ft 4 in) |
| Height overall | 4.86 m (15 ft 11½ in) |
| Tailplane span | 6.45 m (21 ft 2 in) |
| Wheel track | 3.30 m (10 ft 10 in) |
| Wheelbase: | |
| 228-100 | 5.53 m (18 ft 1¾ in) |
| 228-200 | 6.29 m (20 ft 7½ in) |
| Propeller diameter | 2.73 m (8 ft 11½ in) |
| Passenger door (port, rear): | |
| Height | 1.34 m (4 ft 4¼ in) |
| Width | 0.64 m (2 ft 1¼ in) |
| Height to sill | 0.60 m (1 ft 11½ in) |
| Freight door (port, rear): | |
| Height | 1.34 m (4 ft 4¼ in) |
| Width, incl passenger door | 1.28 m (4 ft 2½ in) |
| Baggage door (nose): | |
| Height | 0.50 m (1 ft 7½ in) |
| Width | 1.20 m (3 ft 11¼ in) |
| Baggage door (rear): | |
| Height | 0.76 m (2 ft 6 in) |
| Width | 0.54 m (1 ft 9¼ in) |
| Emergency exits (each): | |
| Height | 0.66 m (2 ft 2 in) |
| Width | 0.48 m (1 ft 7 in) |

DIMENSIONS, INTERNAL:

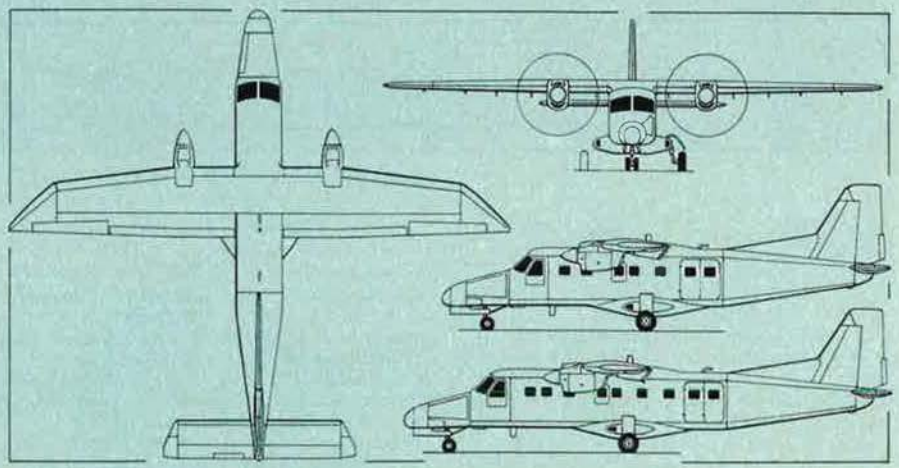
| | |
|---|---|
| Cabin, excl flight deck and rear baggage compartment: | |
| Length: | |
| 228-100 | 6.30 m (20 ft 8 in) |
| 228-200 | 7.08 m (23 ft 2¼ in) |
| Max width | 1.346 m (4 ft 5 in) |
| Max height | 1.55 m (5 ft 1 in) |
| Floor area: | |
| 228-100 | 8.50 m² (91.49 sq ft) |
| 228-200 | 9.56 m² (102.9 sq ft) |
| Volume: | |
| 228-100 | 13.00 m³ (459.1 cu ft) |
| 228-200 | 14.70 m³ (519.1 cu ft) |
| Rear baggage compartment volume: | |
| 228-100, standard | 1.20 m³ (42.4 cu ft) |
| 228-100, optional; 228-200, standard | 2.60 m³ (91.8 cu ft) |
| Nose baggage compartment volume: | 0.89 m³ (31.4 cu ft) |

AREAS:

| | |
|---|---|
| Wings, gross | 32.00 m² (344.3 sq ft) |
| Ailerons (total) | 2.708 m² (29.15 sq ft) |
| Trailing-edge flaps (total) | 5.872 m² (63.21 sq ft) |
| Fin, incl dorsal fin | 4.50 m² (48.44 sq ft) |
| Rudder, incl tab | 1.50 m² (16.15 sq ft) |
| Horizontal tail surfaces (total) | 8.33 m² (89.66 sq ft) |

WEIGHTS:

Weight empty, standard:



**Dornier 228-100 light transport, with additional side view (bottom) of 228-200**
*(Pilot Press)*

| | |
|---|---|
| 228-100 | 2,960 kg (6,526 lb) |
| 228-200 | 3,066 kg (6,760 lb) |
| Max passenger payload: | |
| 228-100 | 2,100 kg (4,630 lb) |
| 228-200 | 1,960 kg (4,321 lb) |
| Max payload (freighter): | |
| 228-100 | 2,297 kg (5,064 lb) |
| 228-200 | 2,163 kg (4,768 lb) |
| Max ramp weight (both) | 5,730 kg (12,632 lb) |
| Max T-O weight (both) | 5,700 kg (12,566 lb) |
| Max landing weight (both) | 5,500 kg (12,125 lb) |
| Max zero-fuel weight (both) | 5,320 kg (11,729 lb) |

PERFORMANCE (at max T-O weight, S/L, ISA, except where indicated):

| | |
|---|---|
| Max diving speed | 255 knots (472 km/h; 293 mph) IAS |
| Max cruising speed at 3,050 m (10,000 ft) | 233 knots (432 km/h; 268 mph) |
| Econ cruising speed at 3,050 m (10,000 ft) | 175 knots (324 km/h; 201 mph) |
| Stalling speed, flaps up: | |
| 228-100 | 79 knots (146 km/h; 91 mph) IAS |
| 228-200 | 81 knots (150 km/h; 93 mph) IAS |
| Stalling speed, flaps down: | |
| 228-100 | 63 knots (117 km/h; 73 mph) IAS |
| 228-200 | 67 knots (124 km/h; 77 mph) IAS |
| Max rate of climb at S/L | 624 m (2,050 ft)/min |
| Rate of climb at S/L, one engine out | 162 m (531 ft)/min |
| Service ceiling, 30.5 m (100 ft)/min rate of climb | 9,020 m (29,600 ft) |
| Service ceiling, one engine out, 30.5 m (100 ft)/min rate of climb | 4,265 m (14,000 ft) |
| T-O run | 415 m (1,362 ft) |
| T-O to 15 m (50 ft) | 579 m (1,900 ft) |
| Landing from 15 m (50 ft) at max landing weight | 600 m (1,968 ft) |
| Range at max cruising speed: | |
| 228-100 | 933 nm (1,730 km; 1,075 miles) |
| 228-200 | 555 nm (1,030 km; 640 miles) |
| Range at 3,050 m (10,000 ft) with max passenger payload, at econ cruising speed, no reserves: | |
| 228-100 | 1,063 nm (1,970 km; 1,224 miles) |
| 228-200 | 621 nm (1,150 km; 715 miles) |
| Ferry range with max fuel | 1,460 nm (2,704 km; 1,680 miles) |

## DORNIER 228 MARITIME PATROL

Dornier has developed two specialised versions of the Dornier 228-100 for maritime patrol. Designated Version A and Version B, they are equipped for particular roles as follows:

**Dornier 228 Maritime Patrol Version A:** Intended for surveillance of domestic and foreign fisheries; territorial tasks and activities of national safety relating to infiltration, prohibited border traffic, and smuggling; and SAR. Primary reconnaissance source is a MEL Marec II radar with 360° scan. The interior of the cabin is laid out to accommodate two observers, each with a forward facing seat adjacent to a bubble window at the forward end of the cabin; a radar operator's station is situated on the port side in a mid-cabin position. There are storage positions for a hand-held camera and a crew liferaft. Two additional liferafts, each with capacity for 20 persons, are optional. There is a double entry door with airstair on the port side, just to the rear of the radar operator's position; a toilet towards the rear of the cabin on the starboard side; and, to its rear, storage and a deployment chute for marine markers, smoke floats, and flares. Two 300A starter/generators are standard to supply power for specialised equipment which, in addition to the Marec II radar, includes Global Navigation GNS-500A-3B VLF/Omega, Collins HF 220 HF com, RT 1327/ARC VHF/AF-FM com, and Becker EB 3100 interphone. Additional equipment in the radar operator's console includes an airspeed indicator, altimeter, and clock; Aeronetics Model 7137 RMI; VLF/Omega control unit; and a Becker ASI-3100 interphone. A Spectrol Sk-16 Nightscan steerable searchlight, mounted externally, is optional.

**Dornier 228 Maritime Patrol Version B:** Intended for surveillance of coastal waters to locate oil spills, survey sea traffic, and protect fisheries. Secondary tasks include the detection of other pollution and the support of SAR missions. Primary surveillance source is an Ericsson/Swedish Space Corporation SLAR. Standard cabin layout provides for the SLAR operator, adjacent to a bubble window on the port side of the cabin; an instrument console almost opposite the SLAR operator on the starboard side with, behind it, a desk and crew rest seat. There is stowage for a crew liferaft, and a toilet as in Version A, but the space behind it is available for installation of an optional Swedish Space Corporation IR/UV scanner system. Other optional equipment includes Bendix RDR-1400 FLAR, Decca-Racal Mk 19 nav system with TANS, or Type 72 Doppler nav system with TANS, plus the additional equipment in the radar operator's console as detailed for Version A.

WEIGHTS (A: Version A; B: Version B):

| | |
|---|---|
| Weight empty, standard: | |
| A, B | 2,960 kg (6,526 lb) |
| Operating weight empty: | |
| A | 3,935 kg (8,675 lb) |
| B | 4,015 kg (8,852 lb) |
| Fuel weight: | |
| A, B | 1,885 kg (4,155 lb) |
| Max T-O weight: | |
| A, B | 5,980 kg (13,183 lb) |
| Typical zero-fuel weight: | |
| A, B | 4,095 kg (9,028 lb) |

PERFORMANCE (A and B at max T-O weight, ISA):

| | |
|---|---|
| Average speed for max range | 165 knots (305 km/h; 190 mph) |
| Average speed for max endurance | 100 knots (185 km/h; 115 mph) |
| *Search time, max range cruise speed at 610 m (2,000 ft), search area adjacent to base | 7 h 45 min |
| *Search time, max range cruise speed at 610 m (2,000 ft), search area 400 nm (740 km; 460 miles) from base | 3 h 45 min |
| *Search time, max endurance cruise speed at 610 m (2,000 ft), search area adjacent to base | 9 h 45 min |
| *Search time, max endurance cruise speed at 610 m (2,000 ft), search area 400 nm (740 km; 460 miles) from base | 4 h 45 min |

*Search time increased by approx 1 h 30 min if optional auxiliary fuel tank installed

a single engineering snag. Spin tests were to be completed following the addition of a tail parachute, to confirm the aircraft's full aerobatic capability.

Meanwhile, Trago Mills is preparing to develop a higher-powered version of the SAH-1, with a 119 kW (160 hp) Avco Lycoming AEIO-320-DB flat-four engine driving a constant-speed propeller.

The following description applies to the prototype as now flying:

TYPE: Two-seat fully aerobatic light aircraft.

WINGS: Cantilever low-wing monoplane. Wing section NACA 2413.6 (constant). Dihedral 5° from roots. Incidence 3° at root, 1° at tip. Tapered, non-swept aluminium alloy wings, with L65 spar booms and L72 sheet skins, stabilised with PVC foam. Trailing-edge single-slotted flaps and slotted ailerons of similar construction.

FUSELAGE: Aluminium alloy stressed skin structure, with radiused corners, incorporating centre-section spars.

TAIL UNIT: Cantilever aluminium alloy structure, stabilised with PVC foam. Constant chord tailplane, attached to fuselage, with horn balanced elevators; full-span trim tab in starboard elevator. Sweptback fin and horn balanced rudder.

LANDING GEAR: Non-retractable tricycle type, with single wheel on each unit. Oleo-pneumatic shock absorber in nosewheel leg; spring steel main legs. Cleveland mainwheels and tyres size 6.00-6, pressure 1.24 bars (18.0 lb/sq in). Nosewheel and tyre size 5.00-5. Cleveland hydraulic brakes.

POWER PLANT: One 88 kW (118 hp) Avco Lycoming O-235-L2A flat-four engine, driving a two-blade fixed-pitch propeller with spinner. Integral fuel tank in each leading-edge, total capacity 114 litres (25 Imp gallons). Refuelling point in upper surface of each wing. Oil capacity 5.7 litres (1.25 Imp gallons).

ACCOMMODATION: Two seats side by side under rearward sliding bubble canopy. Baggage space aft of seats. Cockpit heated and ventilated.

SYSTEM: Electrical system includes 60A engine-driven alternator.

AVIONICS AND EQUIPMENT: Blind-flying instrumentation standard. Radio to customer's specification.


**Dornier 228-100 twin-turboprop 15-passenger light transport**

## TRAGO MILLS

*TRAGO MILLS LIMITED (Aircraft Division): Treswithick Farm, Cardinham, Bodmin, Cornwall PL30 4BU, England*

### TRAGO MILLS SAH-1

Design of the SAH-1, by Mr Sydney A. Holloway, started in October 1977, and construction of a prototype began in January 1978. Both design and construction are to full CAA and FAR Pt 23 standards, and production is intended after certification has been obtained. A first flight had been planned originally for the Summer of 1981, but was delayed by the need to substitute an Avco Lycoming engine for the Rolls-Royce Continental intended originally as power plant of the SAH-1. The first flight with an 88 kW (118 hp) Lycoming was made on 23 August 1983. More than 80 hours of test and demonstration flying had been logged by 1 February 1984, without

| | |
|---|---|
| DIMENSIONS, EXTERNAL: | |
| Wing span | 9.36 m (30 ft 8.4 in) |
| Wing chord: | |
| at root | 1.515 m (4 ft 11½ in) |
| at tip | 0.81 m (2 ft 8 in) |
| Wing aspect ratio | 7.5 |
| Length overall | 6.58 m (21 ft 7¼ in) |
| Height overall | 2.38 m (7 ft 9.6 in) |
| Tailplane span | 2.74 m (9 ft 0 in) |
| Wheel track | 2.29 m (7 ft 6 in) |
| Wheelbase | 1.46 m (4 ft 9.6 in) |
| Propeller diameter | 1.68 m (5 ft 6 in) |
| Propeller ground clearance | 0.25 m (10 in) |
| DIMENSIONS, INTERNAL: | |
| Cockpit: | |
| Length | 1.52 m (5 ft 0 in) |
| Max width | 1.19 m (3 ft 10.8 in) |


**Trago Mills SAH-1 two-seat fully aerobatic light aircraft (Avco Lycoming O-235-L2A engine)**

| | |
|---|---|
| Baggage space | 0.4 m³ (14.0 cu ft) |
| AREAS: | |
| Wings, gross | 11.15 m² (120.0 sq ft) |
| Ailerons (total) | 0.89 m² (9.6 sq ft) |
| Trailing-edge flaps (total) | 1.30 m² (14.0 sq ft) |
| Fin | 0.96 m² (10.3 sq ft) |
| Rudder | 0.63 m² (6.8 sq ft) |
| Tailplane | 1.11 m² (12.0 sq ft) |
| Elevators, incl tab | 0.93 m² (10.0 sq ft) |
| WEIGHTS AND LOADINGS (A with O-235 engine; B with AEIO-320): | |
| Weight empty, equipped: | |
| A | 499 kg (1,100 lb) |
| B | 571 kg (1,259 lb) |
| Max fuel load | 85 kg (188 lb) |
| Max T-O weight: | |
| A | 785 kg (1,731 lb) |
| B | 870 kg (1,919 lb) |
| Max wing loading: | |
| A | 71.83 kg/m² (14.72 lb/sq ft) |
| B | 78.04 kg/m² (15.99 lb/sq ft) |
| Max power loading: | |
| A | 8.92 kg/kW (14.67 lb/hp) |
| B | 7.31 kg/kW (11.99 lb/hp) |
| PERFORMANCE (estimated at max T-O weight): | |
| Never-exceed speed: | |
| A | 202 knots (374 km/h; 232 mph) EAS |
| B | 232 knots (430 km/h; 267 mph) EAS |
| Max level speed at S/L: | |
| A | 121 knots (224 km/h; 139 mph) |
| B | 140 knots (259 km/h; 161 mph) |
| Max cruising speed (75% power) at S/L: | |
| A | 110 knots (204 km/h; 127 mph) |
| B | 126 knots (233 km/h; 145 mph) |
| Econ cruising speed (50% power) at S/L: | |
| A | 93 knots (172 km/h; 107 mph) |
| B | 110 knots (204 km/h; 127 mph) |
| Stalling speed, flaps up: | |
| A | 53 knots (98 km/h; 61 mph) EAS |
| B | 57 knots (106 km/h; 66 mph) EAS |
| Stalling speed, flaps down: | |
| A | 46 knots (85 km/h; 53 mph) EAS |
| B | 51 knots (95 km/h; 59 mph) EAS |
| Max rate of climb at S/L: | |
| A | 256 m (840 ft)/min |
| B | 393 m (1,290 ft)/min |
| Service ceiling: | |
| A | 5,000 m (16,400 ft) |
| B | 6,645 m (21,800 ft) |
| T-O run: | |
| A | 247 m (812 ft) |
| B | 223 m (730 ft) |
| T-O to 15 m (50 ft): | |
| A | 374 m (1,228 ft) |
| B | 315 m (1,033 ft) |
| Landing from 15 m (50 ft): | |
| A | 290 m (953 ft) |
| B | 315 m (1,033 ft) |
| Max range, with 13.6 litres (3 Imp gallons) fuel reserves: | |
| A at 78 knots (145 km/h; 90 mph) at 1,525 m (5,000 ft) | 620 nm (1,149 km; 714 miles) |
| B at 95 knots (175 km/h; 109 mph) at 3,050 m (10,000 ft) | 490 nm (907 km; 564 miles) |

## MAI

*MITSUBISHI AIRCRAFT INTERNATIONAL INC: One Lincoln Centre, 5400 LBJ Freeway, Suite 1500, Dallas, Texas 75240, USA*

### MITSUBISHI DIAMOND IA

The first prototype of this twin-turbofan business jet was completed in the Summer of 1978, shortly before brief details of the aircraft (known in Japan as the MU-300) were released. This aircraft (c/n 001) made its first flight on 29 August 1978 and was followed by a second prototype (c/n 002) on 13 December 1978.

After more than 350 hours of flight testing in Japan, the two prototypes were shipped to the USA in the Summer of 1979 and were reassembled by MAI. The second prototype (N81DM) made the type's first flight in the United States on 10 August 1979. This aircraft was used as the systems and equipment test aircraft in the FAA certification programme, while the first prototype undertook general performance and handling trials.

The next four aircraft were production **Diamond Is** built in Japan and dispatched to the MAI factory at San Angelo for reassembly. The first production Diamond I made its initial flight on 21 May 1981. From the fifth production airframe onward, Mitsubishi (Japan) began shipping the aircraft to MAI in the form of major subassemblies, the US company taking responsibility for assembly, engine and avionics installation, cabin outfitting, and flight testing.

MAI received US certification of the Diamond I on 6 November 1981, in the Transport category of FAR Pt 25 for IFR operation in known icing conditions. Canadian and West German certification were granted on 22 March and 25 August 1983 respectively, with UK certification following on 6 December 1983. Certification has also been granted in Denmark and Finland, and is pending in six other countries, including Australia, Brazil, Italy, and Switzerland.

Initial deliveries of the Diamond I began in July 1982. By January 1984 more than 60 aircraft had been supplied to customers in the USA, Canada, and Europe, including the first Diamond Is for British and West German operators.

An improved **Diamond IA** was announced on 31 August 1983, and is now the standard production version, effective from US c/n 62 which was due for delivery in January 1984. This version has uprated Pratt & Whitney Aircraft of Canada JT15D-4D turbofans providing an additional 5 per cent thrust for improved hot day/high altitude performance, enhanced payload/range and runway requirement capability, higher operating weights, interior restyling, and Sperry EDZ-600 electronic flight instrument system as an option. Retrofit kits for existing Diamond I operators are to become available in 1984.

The following description applies to the Diamond IA:

TYPE: Twin-turbofan business aircraft.

WINGS: Cantilever low-wing monoplane. Mitsubishi computer-designed wing sections: thickness/chord ratio 13.2 per cent at root, 11.3 per cent at tip. Dihedral from roots. Incidence 3° at root. Washout 6° 30'. Sweepback 20° at quarter-chord. Wings are of chemically milled aluminium alloy, built in three portions: a centre-section and two outer panels. Each wing has two primary box-beam spars forming an integral fuel tank. Narrow chord Fowler type flaps over 85 per cent of the trailing-edges, actuated hydraulically and having double-slotted inboard and single-slotted outboard segments. Immediately ahead of the flaps are long span, narrow chord spoilers for roll control which serve also as airbrakes, and can be used as lift dumpers to assist braking on touchdown. Outboard of each outer trailing-edge flap is a small, short span aileron for roll trim. Hot air anti-icing of leading edges.

FUSELAGE: Pressurised, fail-safe fatigue resistant semi-monocoque structure, of oval cross section with flattened cabin floor. Construction is mainly of aluminium alloy, using multiple load paths, bonded doublers, and small skin panels in the principal load-bearing members. Built in three main sections: forward (including flight deck), centre, and rear.

TAIL UNIT: Cantilever T tail, with sweepback on all surfaces. Construction similar to that of wings.


**Mitsubishi Diamond I twin-turbofan business aircraft**

Curved dorsal fin, plus small underfin. A small horizontal strake is fitted to each side of the rear fuselage abreast of the main fin to assist airflow control. Trim tab in base of rudder. Small yaw damping control surface above rudder. Variable incidence tailplane, with elevators. Hot air anti-icing of leading-edges.

LANDING GEAR: Sumitomo retractable tricycle type, with single wheel and oleo-pneumatic shock absorber on each unit. Hydraulically actuated, electrically controlled. Emergency free-fall extension. Nosewheel, steerable by rudder pedals, retracts forward; mainwheels retract inward into fuselage. Goodyear wheels with Goodrich tyres on all units. Goodyear brakes.

POWER PLANT: Two Pratt & Whitney Aircraft of Canada JT15D-4D turbofan engines, mounted in pod on each side of the rear fuselage, each rated at 11.12 kN (2,500 lb st) for take-off, with an additional 3 per cent thrust with ECS system (pressurisation/bleed air) turned off. Rohr thrust reversers optional. Fuel is in two 1,003 litre (220.5 Imp gallon; 265 US gallon) integral tanks in wings, plus a further 401 litres (88 Imp gallons; 106 US gallons) in rear fuselage tank. Total usable fuel capacity 2,407 litres (529 Imp gallons; 636 US gallons). Fully automatic fuel feed system. Refuelling points in upper surface of each wing and on starboard side of fuselage at rear.

ACCOMMODATION: Crew of two on flight deck. Standard layout seats seven passengers in pressurised cabin, with toilet and baggage compartment (capacity 181 kg; 400 lb) at rear. Forward opening crew/passenger door forward of wing on port side. Emergency exit forward of wing on starboard side.

SYSTEMS: Pressurisation system, with max differential of 0.62 bars (9.0 lb/sq in). Backup pressurisation system, using engine bleed air, for emergency use. Hydraulic system, pressure 103.5 bars (1,500 lb/sq in), for actuation of flaps, spoilers, landing gear, wheel brakes, and other services. Electrical system powered by two engine-driven starter/generators. All systems are, where possible, of modular conception: for example, entire hydraulic installation can be removed as a single unit. Stick shaker as backup stall-warning device.

AVIONICS: Standard avionics include Sperry SPZ-900 integrated flight control system, with pilot's flight director, encoding altimeter, dual nav/com and audio systems, ADF, DME, ATC transponder, twin compasses and RMIs, and Sperry colour weather radar. GNS-500A Srs 2 or Srs 3B VLF/Omega navigation system and Sperry EDZ-600 electronic flight instrument system optional.

DIMENSIONS, EXTERNAL:

| | |
|---|---|
| Wing span | 13.25 m (43 ft 6 in) |
| Wing aspect ratio | 7.54 |
| Length overall | 14.75 m (48 ft 5 in) |
| Fuselage: | |
| Length | 13.15 m (43 ft 2 in) |
| Max width | 1.68 m (5 ft 6 in) |
| Max depth | 1.85 m (6 ft 1 in) |
| Height overall | 4.19 m (13 ft 9 in) |
| Tailplane span | 5.00 m (16 ft 5 in) |
| Wheel track | 2.84 m (9 ft 4 in) |
| Wheelbase | 5.86 m (19 ft 3 in) |
| Crew/passenger door: | |
| Height | 1.27 m (4 ft 2 in) |
| Width | 0.71 m (2 ft 4 in) |

DIMENSIONS, INTERNAL:

| | |
|---|---|
| Cabin: | |
| Max length, incl flight deck | 6.37 m (20 ft 11 in) |
| Length, excl flight deck | 4.76 m (15 ft 7 in) |
| Max width | 1.50 m (4 ft 11 in) |
| Max height | 1.45 m (4 ft 9 in) |
| Volume: | |
| incl flight deck | 11.33 m³ (400 cu ft) |
| excl flight deck | 8.64 m³ (305 cu ft) |
| Baggage compartment volume | 1.4 m³ (50 cu ft) |

AREAS:

| | |
|---|---|
| Wings, net | 22.43 m² (241.4 sq ft) |
| Trailing-edge flaps (total) | 2.62 m² (28.2 sq ft) |

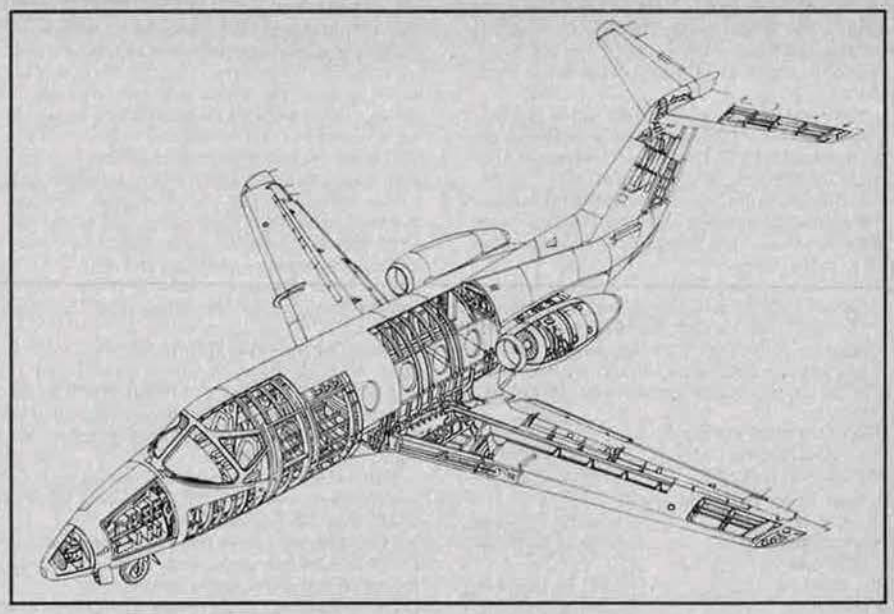
WEIGHTS AND LOADINGS:

| | |
|---|---|
| Weight empty, equipped | 4,087 kg (9,010 lb) |
| Basic operating weight empty | 4,268 kg (9,410 lb) |
| Max fuel | 1,932 kg (4,260 lb) |
| Max payload | 839 kg (1,850 lb) |
| Payload with max fuel | 467 kg (1,030 lb) |
| Max T-O weight | 6,636 kg (14,630 lb) |
| Max ramp weight | 6,668 kg (14,700 lb) |
| Max landing weight | 5,988 kg (13,200 lb) |
| Max zero-fuel weight | 5,148 kg (11,350 lb) |
| Max wing loading | 295.75 kg/m² (60.6 lb/sq ft) |
| Max power loading | 299 kg/kN (2.93 lb/lb st) |

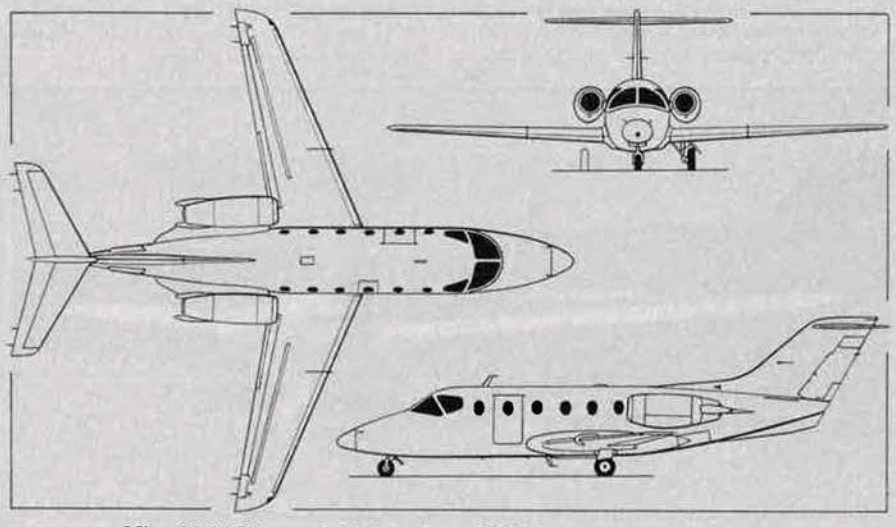
PERFORMANCE (at max T-O weight except where indicated):

| | |
|---|---|
| Max operating Mach number (Mmo) above 7,925 m (26,000 ft) | Mach 0.785 |
| Max operating speed (Vmo) between 4,875 m (16,000 ft) and 7,925 m (26,000 ft) | 320 knots (593 km/h; 368 mph) IAS |
| Max level speed at 9,145 m (30,000 ft) | Mach 0.73 (430 knots; 797 km/h; 495 mph) |
| Typical cruising speed at 11,890 m (39,000 ft) | Mach 0.70 (400 knots; 741 km/h; 461 mph) |
| Long-range cruising speed at 11,890 m (39,000 ft) | Mach 0.66 (375 knots; 695 km/h; 432 mph) |
| Stalling speed, flaps down, at AUW of 4,990 kg (11,000 lb) | 77 knots (143 km/h; 89 mph) IAS |
| Max rate of climb at S/L, ISA | 930 m (3,050 ft)/min |
| Rate of climb at S/L, ISA, one engine out | 232 m (761 ft)/min |
| Max operating altitude | 12,500 m (41,000 ft) |
| * FAA T-O field length at S/L, ISA | 1,174 m (3,850 ft) |
| FAA landing field length at S/L, ISA, at max landing weight | 853 m (2,800 ft) |
| Range with four passengers at long-range cruising speed, ISA, zero wind: | |
| NBAA IFR reserves (100 nm; 185 km; 115 mile alternate) | 1,260 nm (2,333 km; 1,440 miles) |
| NBAA VFR reserves | 1,510 nm (2,797 km; 1,740 miles) |

*Preliminary performance estimate, subject to change pending FAA certification



**Cutaway drawing of the Diamond IA, which carries seven passengers and two crew in standard configuration**



**Mitsubishi Diamond IA (two Pratt & Whitney Aircraft of Canada JT15D-4D turbofan engines)** *(Pilot Press)*

## MITSUBISHI DIAMOND II

In September 1983 MAI announced development of a more powerful **Diamond II**, to be powered by two Pratt & Whitney Aircraft of Canada JT15D-5 turbofan engines. The Diamond II will be externally similar to the Diamond IA, with improvements to payload, cruise speeds, and range, and enhanced hot day/high altitude performance. New interior designs are being prepared for the Diamond II pas-

senger cabin. A fully digital flight control system and electronic flight instrument system will be offered as an option. Deliveries are expected to begin in 1985.

Plans to develop a **Diamond III** with larger passenger cabin in a stretched fuselage were also announced in late 1983. This aircraft is expected to be ready for customer delivery in 1987–88.

The following description is based on preliminary engineering estimates of Diamond II specification and performance, and is subject to change pending FAA certification:

POWER PLANT: Two Pratt & Whitney Aircraft of Canada JT15D-5 turbofan engines, each rated at 12.9 kN (2,900 lb st) for take-off. Total usable fuel capacity 2,407 litres (529 Imp gallons; 636 US gallons) standard; with optional long range tank 2,786 litres (613 Imp gallons; 736 US gallons).

WEIGHTS:

| | |
|---|---|
| Weight empty, equipped: | |
| standard tanks | 4,118 kg (9,080 lb) |
| optional tanks | 4,175 kg (9,205 lb) |
| Basic operating weight, empty: | |
| standard | 4,418 kg (9,740 lb) |
| optional | 4,475 kg (9,865 lb) |
| Max fuel: | |
| standard | 1,932 kg (4,260 lb) |
| optional | 2,236 kg (4,930 lb) |
| Max payload: | |
| standard | 975 kg (2,150 lb) |
| optional | 918 kg (2,025 lb) |
| Payload with max fuel: | |
| standard | 562 kg (1,240 lb) |
| optional | 424 kg (935 lb) |
| Max T-O weight: | |
| standard | 6,881 kg (15,170 lb) |
| optional | 7,103 kg (15,660 lb) |
| Max ramp weight: | |
| standard | 6,913 kg (15,240 lb) |
| optional | 7,135 kg (15,730 lb) |
| Max landing weight | 6,305 kg (13,900 lb) |
| Max zero-fuel weight | 5,393 kg (11,890 lb) |

PERFORMANCE (estimated at 5,897 kg; 13,000 lb mid-cruise weight except where indicated):

Max level speed at 8,840 m (29,000 ft)
456 knots (845 km/h; 525 mph)
Typical cruising speed at 11,890 m (39,000 ft)
439 knots (813 km/h; 505 mph)
Long-range cruising speed at 12,500 m (41,000 ft)
394 knots (730 km/h; 454 mph)
Max operating altitude 12,500 m (41,000 ft)
FAA T-O field length at S/L, ISA, max T-O weight:
standard 1,040 m (3,410 ft)
optional 1,119 m (3,670 ft)
FAA landing field length at S/L, ISA, max landing weight:
both versions 850 m (2,787 ft)
Range with four passengers, at long range cruising speed, ISA, zero wind, T-O weight 6,881 kg (15,170 lb):
NBAA IFR reserves (100 nm; 185 km; 115 mile alternate):
standard 1,190 nm (2,205 km; 1,370 miles)
optional 1,460 nm (2,705 km; 1,681 miles)
NBAA VFR reserves:
standard 1,580 nm (2,928 km; 1,819 miles)
optional 1,850 nm (3,428 km; 2,130 miles)

## DÄTWYLER

*MDC MAX DÄTWYLER AG: Flugplatz, CH-3368 Bleienbach-Langenthal, Switzerland*

Dätwyler has specialised for many years in the repair and modification of light aircraft, and was responsible for the MDC-Trailer glider towing aircraft described in the 1966–67 *Jane's*. It has also manufactured components for the Pilatus Porter/Turbo-Porter STOL light transport aircraft and B4-PC11 sailplane, and for the Dassault Mercure jet transport. Its latest design is the MD-3 Swiss Trainer.

### DÄTWYLER MD-3 SWISS TRAINER

Dätwyler announced preliminary details of a two-seat basic training aircraft named the Swiss Trainer in the late 1960s. Since then the general configuration has undergone little change, but considerable effort has been made by Mr Max Dätwyler to make the design genuinely modular in nature, and so facilitate its manufacture by potential licensees in countries without a developed aircraft industry. In particular the ailerons, two-segment flaps, elevators, and rudder constitute nine control surfaces which are all basically identical and interchangeable. The same is true of the tailplane halves and fin; fin and tailplane tips; wing leading-edge sections (four per aircraft); and the central inner and outer portions of the wings. Stock-keeping is thus simplified, as well as manufacture.

The MD-3 prototype (HB-HOH) made its first flight, with Mr Dätwyler at the controls, on 12 August 1983. Certification to FAR Pt 23, in the Aerobatic and Utility categories, is under way. Two versions of the Swiss Trainer are planned, as follows:

**MD-3-115.** Two-seat primary training version, powered by an 82 kW (110 hp) Avco Lycoming O-235-N2A flat-four engine.

**MD-3-160.** With more powerful Avco Lycoming O-320-D2A engine; particularly suitable for glider towing. Prototype is of this version.

The following description applies to the MD-3-160, except where indicated:

TYPE: Two-seat primary training aircraft and glider tug, of modular construction.

WINGS: Cantilever mid-wing monoplane. Wing section NACA $64_2$15414 (modified). Thickness/chord ratio 14 per cent. Dihedral 4°. Incidence 2°. No sweepback. All-metal structure, with single main spar, consisting of five different modules, of which the largest measures 3.45 × 0.67 × 0.21 m (136 × 26.4 × 8.3 in). All-metal mechanically operated two-segment flaps; single-slotted mass balanced ailerons. Flap, aileron, rudder, and elevator segments identical.

FUSELAGE: Mainly metal semi-monocoque structure, with glassfibre fairings and cowling. Tailboom detachable from fuselage aft of wing.

TAIL UNIT: Sweptback vertical and horizontal surfaces of all-metal two-spar construction, assembled from three equal modules. Dorsal fin. Mass-balanced rudder and elevators, modules of which are identical to those of ailerons and flaps.

LANDING GEAR: Non-retractable tricycle type with steerable nosewheel. Main-gear legs are cantilever steel struts, descending at 45° from fuselage main bulkhead. Nose gear fitted with oleo-pneumatic shock absorber. Cleveland 6.00-6 mainwheels and 5.00-5 nosewheel. Independent hydraulically operated Cleveland disc brake on each mainwheel. Speed fairings optional on all three wheels.

POWER PLANT: One 119 kW (160 hp) Avco Lycoming O-320-D2A flat-four engine in MD-3-160, driving a Hoffmann two-blade fixed-pitch wooden propeller with spinner (82 kW; 110 hp O-235-N2A in MD-3-115). One integral fuel tank in each wing; total capacity 140 litres (36 US gallons). Refuelling point above each wing. Oil capacity 7.6 litres (2 US gallons).

ACCOMMODATION: Side by side adjustable seats for pilot and one passenger. Five-point fixed seat belts. Forward sliding canopy. Space behind seats for 50 kg (110 lb) of baggage. Dual controls, cabin ventilation, and heating standard.

SYSTEMS: Hydraulic system for brakes only. One 28V 60A engine-driven alternator and one 24V 30Ah battery provide electrical power for engine starting, lighting, instruments, communications, and navigation installations.

AVIONICS AND EQUIPMENT: Provision for VHF radio, VOR, ADF, transponder, or other special equipment at customer's option. Equipment for glider towing optional.

DIMENSIONS, EXTERNAL:

| | |
|---|---|
| Wing span | 10.00 m (32 ft 9¾ in) |
| Wing chord, constant | 1.50 m (4 ft 11 in) |
| Wing aspect ratio | 6.67 |
| Length overall | 6.98 m (22 ft 10¾ in) |
| Height overall | 2.92 m (9 ft 7 in) |
| Tailplane span | 3.00 m (9 ft 10 in) |
| Wheel track | 2.00 m (6 ft 6¾ in) |
| Wheelbase | 1.56 m (5 ft 1½ in) |
| Propeller diameter | 1.82 m (5 ft 11½ in) |
| Propeller ground clearance | 0.27 m (10½ in) |

DIMENSIONS, INTERNAL:

| | |
|---|---|
| Cabin, from firewall to rear bulkhead: | |
| Length | 1.30 m (4 ft 3¼ in) |
| Max width | 1.12 m (3 ft 8 in) |
| Max height | 1.08 m (3 ft 6½ in) |

AREAS:

| | |
|---|---|
| Wings, gross | 15.00 m² (161.5 sq ft) |
| Ailerons (total) | 1.22 m² (13.13 sq ft) |
| Trailing-edge flaps (total) | 1.96 m² (21.10 sq ft) |
| Vertical tail surfaces (total) | 1.44 m² (15.50 sq ft) |
| Rudder | 0.51 m² (5.49 sq ft) |
| Horizontal tail surfaces (total) | 2.56 m² (27.56 sq ft) |
| Elevator | 1.04 m² (11.19 sq ft) |

WEIGHTS AND LOADINGS (A: Aerobatic; U: Utility):

| | |
|---|---|
| Weight empty | 570 kg (1,256 lb) |
| Max T-O and landing weight: | |
| A | 750 kg (1,653 lb) |
| U | 900 kg (1,984 lb) |
| Max wing loading: | |
| A | 50.0 kg/m² (10.25 lb/sq ft) |
| U | 60.0 kg/m² (12.29 lb/sq ft) |
| Max power loading: | |
| A | 6.29 kg/kW (10.33 lb/hp) |
| U | 7.55 kg/kW (12.40 lb/hp) |

PERFORMANCE (MD-3-160 at T-O weight of 815 kg; 1,796 lb):

Never-exceed speed
169 knots (313 km/h; 195 mph)
Max manoeuvring speed
133 knots (246 km/h; 153 mph)
Max cruising speed (75% power) at 1,525 m (5,000 ft) 124 knots (230 km/h; 143 mph)
Econ cruising speed (66% power) at 1,525 m (5,000 ft) 117 knots (217 km/h; 135 mph)
Stalling speed, engine idling:

**This ground shot of the Dätwyler MD-3-160 shows well the superb field of view from the side by side cockpit**

| | |
|---|---|
| flaps up | 56 knots (104 km/h; 65 mph) |
| flaps down 33° | 46 knots (85 km/h; 53 mph) |
| Max rate of climb at S/L | 420 m (1,378 ft)/min |
| Max rate of climb (75% power) towing 365 kg (805 lb) sailplane | 104 m (341 ft)/min |
| T-O run | 108 m (354 ft) |
| Landing run | 130 m (426 ft) |
| Range with max fuel, no reserves | 588 nm (1,090 km; 677 miles) |

## NORTHROP

*NORTHROP CORPORATION (AIRCRAFT DIVISION): 3901 West Broadway, Hawthorne, California 90250, USA*

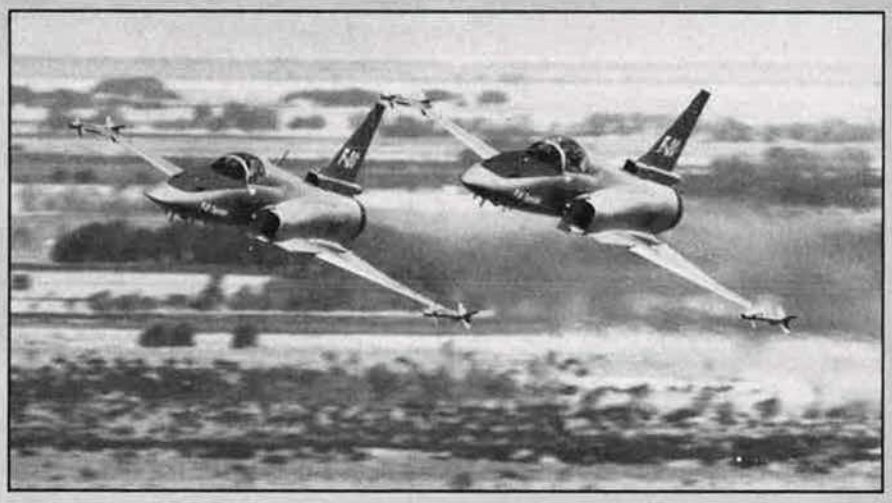
### NORTHROP F-20 TIGERSHARK

This export fighter, originally designated F-5G by Northrop, evolved from company studies which showed that a more advanced version of the F-5 with a single General Electric F404-GE-100 turbofan engine, in place of the two standard General Electric J85 turbojets, would result in a combat aircraft with much improved performance at reasonable cost. With an empty weight increase of only 15 per cent compared with the F-5E, the Tigershark has a 70 per cent increase in engine thrust and offers significant performance improvements.

Early wind tunnel testing suggested that the Tigershark would retain F-5 handling characteristics throughout the expanded flight envelope. Economies in procurement and operation would result from the interchangeability of many F-5E/Tigershark components and the retention of existing support and training systems, plus the improved reliability and reduced maintenance associated with the General Electric F404 engine.

In January 1980, Northrop made a decision to proceed with the construction and development of prototype and pre-production aircraft. Later that year, in response to a Presidential directive for private development of a fighter to modernise the air forces of friendly foreign nations, the USAF Systems Command became involved in overseeing the Tigershark programme, enabling the aircraft to be sold abroad through the foreign military sales (FMS) operation. USAF responsibilities include verifying that the aircraft meets its specifications, overseeing and participating in aircrew and maintenance training of personnel from countries that purchase the Tigershark, and developing with Northrop the worldwide logistics support programme required.

The first Tigershark (82-0062, now N4416T), with analog avionics and an F-5E style canopy, made its first flight on 30 August 1982 and was officially designated F-20A on 23 November that year. In the Spring of 1983 its 71.2 kN (16,000 lb st) engine was replaced with a 75.6 kN (17,000 lb st) version, test flying with the latter engine being resumed on 30 June 1983. The second Tigershark (N3986B), which flew for the first time on 26 August 1983, has digital avionics and a bulged canopy with 45 per cent more transparency area, giving an improved all-round field of view. A third aircraft, more than 60 per cent complete by January 1984, is scheduled to fly later this year.



**Northrop's first two prototype F-20 Tigersharks flying in close formation near Edwards Air Force Base, California**

The 100th F-20 test flight was recorded on 7 January 1983, and 500 flights had been made by the end of 1983, with a demonstrated mission reliability rate of 97 per cent. The flight envelope had been expanded to a planned 800 knots (1,482 km/h; 921 mph) CAS at 1,525 m (5,000 ft); the aircraft had atttained a top speed of Mach 2 and been flown to its limit of 9*g*; and on 1 December 1983, on its 68th flight, the second prototype, carrying three 1,041 litre (275 US gallon) external fuel tanks, made an unrefuelled transcontinental flight of 2,004 nm (3,714 km; 2,308 miles) from Edwards AFB, California, to Andrews AFB, Maryland, in 3 h 47 min.

No orders for the Tigershark had been announced by 1 February 1984, but the company has stated that four customers, ordering 100 aircraft between them, would be considered sufficient to launch series production. Deliveries could be made within 24 months from go-ahead.

TYPE: Single-seat multi-role fighter and attack aircraft.

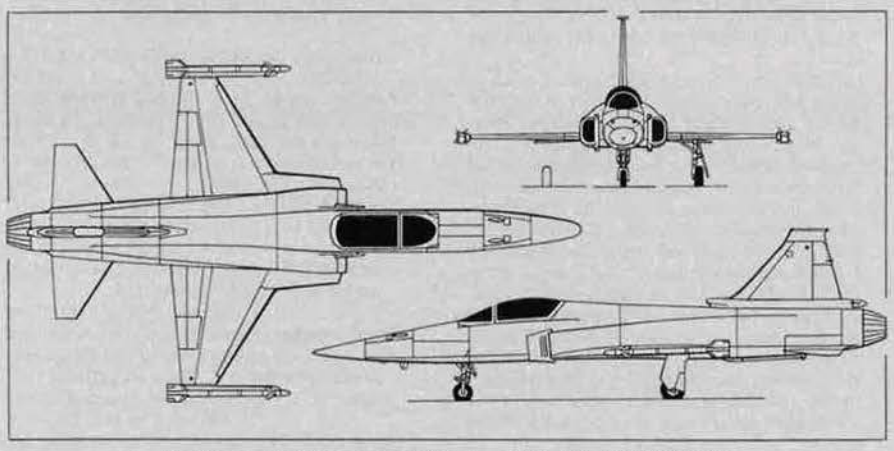
WINGS: Cantilever low-wing monoplane. Wing section NACA 65A004.8 (modified). No dihedral or incidence. Sweepback at quarter-chord 25°. Multi-spar light alloy structure with heavy plate machined skins, thickened on inboard sections compared with F-5E. Hydraulically powered sealed-gap ailerons at approximately mid span, with artificial feel control. Light alloy single-slotted trailing-edge flaps, inboard of ailerons, and leading-edge flaps are actuated hydraulically by electromechanical drive system and are programmed as a function of airspeed and angle of attack. Compared with F-5E the tapered leading-edge extensions, between inboard leading-edge and fuselage, are increased and refined in conjunction with engine inlet duct redesign. This change to the leading-edge extensions, with full flaps, reduces effectively the combat wing loading (with 50 per cent fuel) from 390 kg/m² (80 lb/sq ft) to an equivalent wing loading of 261 kg/m² (53.5 lb/sq ft) at maximum lift. No de-icing system.

FUSELAGE: Basically as for F-5E (light alloy semi-monocoque basic structure, with steel, magnesium, and titanium in certain areas), but nose flattened slightly and rounded in planform (shark nose) to enhance directional stability at high angles of attack. Brunswick Corporation dielectric nose radome. Area ruling in the mid fuselage section is eliminated because of the higher thrust available. The rear fuselage is narrower as a result of the power plant change, but the longitudinal stability characteristics of earlier F-5s are retained by the addition of step fairings beneath the rear fuselage which are also utilised to mount the tailplane. A single variable geometry exhaust nozzle replaces the twin nozzles of the F-5E power plant. Hydraulically actuated magnesium alloy airbrake beneath fuselage, forward of mainwheel wells. Avionics bay and cockpit pressurised; fail-safe structure in pressurised areas.

TAIL UNIT: Cantilever structure, with powered rudder and one-piece all-moving tailplane both actuated hydraulically (by dual actuators) and having artificial feel control. No tabs. Tailplane is of totally new design compared with that of F-5E, with exposed area increased by 30 per cent. Closed loop digital pitch control augmentation system (PCAS) designed to facilitate a further-aft CG for reduced trim drag. Tailplane constructed of full depth aluminium honeycomb with graphite/epoxy composite skins, spar, and ribs. Fin, also totally new, has 20 per cent less exposed area due to improved afterbody flow; it is a seven-spar aluminium alloy structure with honeycomb leading/trailing-edge sections and graphite/epoxy composite skins. Ram air inlet at base of fin to cool ECS engine bleed line, accessory gearbox oil, and 40kVA generator.

LANDING GEAR: Hydraulically retractable tricycle type, main units retracting inward into engine air intake trunks, nosewheel forward. Northrop oleo-pneumatic shock absorber in each unit. Two-position extending nose unit increases static angle of attack to reduce take-off distance, and is shortened automatically during the retraction cycle. Gravity operated emergency extension. Goodyear mainwheels and tyres size 24 × 8.0-13. Steerable nose unit with wheel and tyre size 18 × 6.5-8. Multiple-disc carbon brakes.

POWER PLANT: One 80.1 kN (18,000 lb st) class General Electric F404-GE-100 afterburning turbofan engine in rear fuselage, with fuel control



**Northrop F-20 Tigershark (General Electric F404-GE-100 afterburning turbofan engine)** *(Pilot Press)*

redundancy for single-engine application. In-flight restarts can be made by windmilling or onboard hydrazine fuel starter. Fuel system, capacity 2,290 kg (5,050 lb), generally as for F-5E, but in Goodyear bladder tanks in fuselage, rearranged to supply single engine. No fuel carried in wings. Three 1,041 litre (275 US gallon) or 1,249 litre (330 US gallon) jettisonable auxiliary fuel tanks can be carried on fuselage centreline and inboard underwing pylons. Single refuelling point in lower fuselage for internal and external tanks. Provision for tactical in-flight refuelling capability, using centreline aerial refuelling system. In tanker configuration, can extend the strike radius of a flight of four F-20s from 540 nm (1,000 km; 620 miles) to more than 700 nm (1,300 km; 810 miles).

ENGINE INTAKES: Fixed geometry, side mounted vertical ramp inlets, separated from fuselage by boundary layer splitter plate and supplemented by auxiliary air inlet doors for use during take-off and low-speed flight, as in F-5E. Compared with F-5E, intakes are extended forward, enlarged slightly, and sited further outboard from the fuselage to accommodate the increased boundary layer thickness generated at higher airspeeds. Internal ducting is sized to accommodate planned growth versions of the F404 engine.

ACCOMMODATION: Pilot only, in pressurised, heated, and air-conditioned cockpit, on Stencel SIIIS-3F20 rocket powered zero/zero ejection seat. Upward opening bubble canopy, hinged at rear, has 45 per cent more transparency area than that of F-5E, combining with improved headrest design to extend all-round field of view.

SYSTEMS: Hamilton Standard air-conditioning and demisting systems. Hydraulic system incorporates Ronson actuators. Primary electrical power for all aircraft systems is provided by a Westinghouse 40kVA constant frequency brushless generator, driven from the accessory gearbox, which supplies 115/200V three-phase AC at 400Hz. A Westinghouse 5kVA engine-driven brushless generator supplies 115/200V three-phase emergency AC power at 290–480Hz for flight control avionics, intercom, INS, ADI, VHF/UHF, IFF, radar warning receiver, blanker, DME, mission computer, ILS, left DDI, jettison, chaff/flare dispensers, gun firing and purging, directional gyro, HUD, CNI interface unit, display processor, and data entry panel. A Hamilton Standard 250VA solid state inverter can provide 115V emergency AC at 400Hz in the event of engine flameout. 28V DC power for all electrical systems is supplied by an Avtech 100A solid state transformer-rectifier; two Marathon 24V 17Ah nickel-cadmium batteries provide emergency DC during engine flameout for hydraulic pump, jettison, airbrake, flap control, engine instruments, flight control avionics, INS memory, CAS, back-up IGN control, cartridge start, engine controls, fuel pump, Tacan, UHF radio, IFF, fire detector, and caution/warning lights. Hydromechanical/electromechanical flight control system with Hamilton Standard electronic dual-channel digital pitch and yaw control augmentation.

AVIONICS AND EQUIPMENT (production Tigershark): Com/nav avionics comprise Collins AN/ARC-182(V) VHF/UHF-AM/FM solid state com transceiver; Honeywell inertial navigation set, with ring laser gyros; Collins DF-301E UHF/ADF; Collins VIR-130 solid state VOR/ILS receiver with VOR/LOC, glideslope, and marker beacon receiver; Collins DME-40; Teledyne Systems AN/APX-101(V) solid state IFF transponder; Northrop com/nav/identification (CNI) interface unit, controlling VHF/UHF, VOR/ILS, IFF, DME, UHF/ADF, and directional gyro; and Northrop auxiliary CNI control panel. General Electric AN/APG-67(V) X-band coherent pulse-Doppler multi-mode radar, with advanced digital signal processing, has lookup/lookdown detection range of 48/31 nm (89/57 km; 55/36 miles) and track-while-scan in air-to-air mode; ground mapping, Doppler beam sharpening, and moving target indication/track in air-to-ground mode; surface search and moving target indication/track in air-to-sea mode. Displays and controls include


**Northrop F-20 Tigershark dropping five Mk 82 bombs**

General Electric head-up display; dual-channel digital display processor, digital display indicator (DDI) with combined electro-optical and symbology presentations, and data entry panel, all by Bendix; sensor control panel (for radar and INS master mode) and volume control panel (for audio systems), both by Northrop; and Teledyne Systems fault warning panel. Data processing equipment includes Teledyne Systems solid state digital mission computer for weapon computations and avionics systems control/testing, meeting USAF MIL-STD-1750A standards; and Raychem multiplex bus coupler unit and bus termination unit. Flight and other instrumentation includes dual-channel digital flight control computer and air data computer, both by Hamilton Standard; Sperry Flight Systems CN-125/ASN-89(V) directional gyro; Clifton Precision Products AVU-8B/A airspeed indicator and AAU-34/A altimeter; Aerosonics AAU-18/A rate of climb indicator and AQU-3/A magnetic compass; Jet Electronics ARU-42/A attitude indicator and Astronautics ARU-20/A remote attitude indicator; Sperry Flight Systems DT-309/AJN magnetic azimuth detector; Rosemount pitot static system; Conrac Corporation TRU-180/A angle of attack transmitter; ALU-12/A pitch trim indicator; engine instrumentation; digital clock; headset and microphone amplifiers. Optional avionics include AN/ALR-46 radar warning receiver; AN/ALE-40 countermeasures (chaff/flare) dispenser system; and Northrop AN/ALQ-171(V) conformal countermeasures system.

ARMAMENT: Two 20 mm M39A2 cannon in upper forward fuselage, with 450 rds. Northrop gun control unit; Bowmar 'rounds remaining' counter; Photo-sonics gun/weapon camera. Centreline, four underwing, and two wingtip stations for external stores. Base Ten pylon interface unit. Electrodynamics interface unit for AIM-9 missiles; Northrop weapons release/jettison control unit. Centreline and four underwing pylons can accommodate more than 3,630 kg (8,000 lb) of external weapons or fuel. Typical loads can include up to three General Electric GPU-5/A 30 mm gun pods; up to six AIM-9 Sidewinder air-to-air missiles; up to four Maverick air-to-surface or Harpoon anti-shipping missiles; 2.75 in unguided rockets (FFAR); up to nine Mk 82 bombs (five on c/l multiple ejector rack and four on underwing pylons); or four laser-guided bombs.

DIMENSIONS, EXTERNAL:

| | |
|---|---|
| Wing span: | |
| without missiles | 8.13 m (26 ft 8 in) |
| over missiles | 8.53 m (27 ft 11.9 in) |
| Wing chord (mean aerodynamic) | 2.59 m (8 ft 6.14 in) |
| Length overall | 14.19 m (46 ft 6½ in) |
| Height overall | 4.22 m (13 ft 10¼ in) |
| Tailplane span | 4.725 m (15 ft 6.04 in) |
| Wheel track | 3.80 m (12 ft 5½ in) |
| Wheelbase | 5.30 m (17 ft 4¼ in) |

AREA:

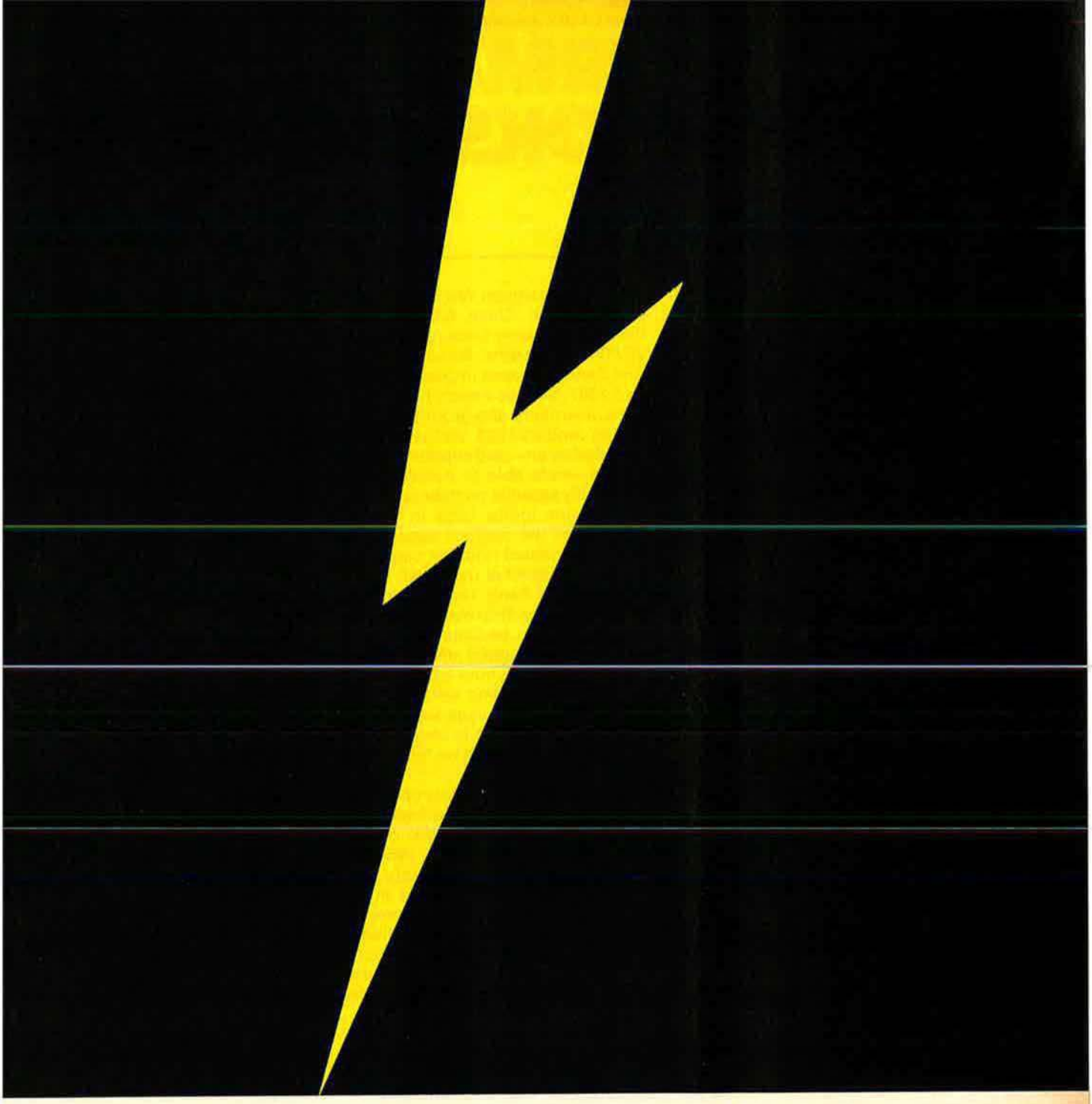
| | |
|---|---|
| Wings, gross reference area | 18.58 m² (200.0 sq ft) |

WEIGHTS:

| | |
|---|---|
| Weight empty | 5,089 kg (11,220 lb) |
| Max fuel load: | |
| internal | 2,290 kg (5,050 lb) |
| external | 2,919 kg (6,435 lb) |
| Max external stores load | more than 3,630 kg (8,000 lb) |
| Combat T-O weight, 2 Sidewinders and 50 per cent fuel | 7,176 kg (15,820 lb) |
| Max T-O weight: | |
| 'clean' | 8,409 kg (18,540 lb) |
| with external stores | 12,474 kg (27,500 lb) |
| Combat thrust/weight ratio | 1.1 |

PERFORMANCE (at 8,167 kg; 18,005 lb 'clean' T-O weight except where indicated):

| | |
|---|---|
| Max level speed at high altitude | approx Mach 2 |
| Max rate of climb at S/L | 16,090 m (52,800 ft)/min |
| Time to 12,200 m (40,000 ft) from brake release | 2 min 18 s |
| Sustained air turning rate at Mach 0.8 at 4,575 m (15,000 ft) | 11.1°/s |
| Combat ceiling | 16,670 m (54,700 ft) |
| Service ceiling | 16,765 m (55,000 ft) |
| T-O run 'clean' (S/L, ISA) | 488 m (1,600 ft) |
| T-O run at max T-O weight | 1,280 m (4,200 ft) |
| Landing run (S/L, ISA) | 793 m (2,600 ft) |
| Combat radius with max internal fuel, two 1,041 litre (275 US gallon) external tanks, two Sidewinder missiles, seven Mk 82 bombs, 5 min combat at S/L military power, 20 min fuel reserves at S/L, hi-lo-hi mission | 385 nm (713 km; 443 miles) |
| Combat radius with max internal fuel, three 1,041 litre (275 US gallon) external tanks, two Sidewinder missiles, 1 h 37 min on patrol, 20 min fuel reserves at S/L, combat air patrol mission | 300 nm (556 km; 345 miles) |
| Ferry range with max internal and external fuel | 1,620 nm (3,000 km; 1,865 miles) |
| *g* limit | +9.0 |



In July, AIR FORCE Magazine presents...

# THE ELECTRONIC AIR FORCE

Closing for advertising reservations
is May 25, copy by June 6.

# AIRMAN'S BOOKSHELF

## History and Heroics

*Tactical Airlift,* by Ray L. Bowers. Government Printing Office (Office of Air Force History), Washington, D. C., 1983. 899 pages with photos, maps, footnotes, bibliography, and index. $14.

Ray L. Bowers has written the first scholarly history of airlift of any war. His book details the saga of the C-7s, C-123s, and C-130s from the beginning of American involvement in Vietnam to the final tragedy.

Tactical airlift—delivering goods and people within the theater—was the glue that held together the war effort in South Vietnam.

In any phase of an insurgency, the ruling government is at a disadvantage because it must appear capable of securing the entire population and thus spreads its defensive forces thinly. Insurgents, however, can mass at points of their own choosing and overwhelm defenders in static positions.

Even with a smaller force overall, guerrillas can wreak havoc for extended periods and make the government appear impotent. It was airlift (and, of course, airpower in general) that helped hold the enemy for a decade, hauling everything in response to the needs of friendly forces. The best example of timely tactical airlift was during the Tet offensive in 1968.

During that countrywide battle, tactical airlifters repositioned tens of thousands of troops to defeat widespread attacks, and routinely delivered by air thousands of tons of ammunition and supplies to sustain isolated forces.

Airlift was essential because the enemy had cut ground lines of communication. Often troops were carried from one small austere airfield to another—a mission, incidentally, the C-17 will be able to accomplish, but C-141s and C-5s can't. The repulse of the enemy attack was in large measure the product of timely combat airlift.

Perhaps the best known airlift mission of the Vietnam War was sustaining Khe Sanh. There, 6,000 Marines held off an enemy force of more than 20,000 for months. Road supply to Khe Sanh had been impossible since mid-1967, and the enemy began continuous artillery and ground assaults during January 1968, yet the Marines, supplied by air—and supported by air strikes—were able to persevere despite daily assaults on their positions.

Khe Sanh looms large in the war because of the political success the Viet Minh gained from the capture of a similar outpost at Dien Bien Phu in 1954. At Khe Sanh, tactical airlifters landed until the strip was in such poor shape that this became impossible. They then airdropped and performed low-altitude parachute extractions of munitions, food, and water into the outpost until the siege was broken three months later. It is very possible that Khe Sanh could have fallen without this support.

The book is also a history of heroes. Read about Lt. Col. Joe Jackson's rescue of a three-man combat control team from Kham Duc in May 1968. In a command and control snafu, the three men had been inserted into a camp to assist an emergency evacuation, but all friendlies had already been evacuated. The three men found themselves in an abandoned camp with nothing but sidearms for defense.

On the runway were the remains of half a dozen aircraft and the enemy was firing at the team from a machine-gun nest beneath the wing of a destroyed C-130.

Not only did the enemy own the airfield, but he held the high ground around it and was able to fire down at any aircraft trying to land on the strip. As the ammunition dumps at Kham Duc were exploding and the field was engulfed in flame and smoke, Jackson and his crew dove their aircraft for the runway in a rescue attempt. His success earned him the Medal of Honor, the first to go to an airlifter in any war.

Read also about the resupply of besieged An Loc in April 1972 when Capt. Bill Caldwell took his C-130 over the drop zone and was struck by heavy antiaircraft artillery and machine-gun fire. The ground fire smashed Caldwell's windscreen, killed the flight engineer, and wounded the copilot and navigator.

Moreover, the aircraft's cargo of ammunition was smoldering in intense heat caused by a ruptured hot air line. Loadmasters jettisoned the ammunition and fought the flames with fire extinguishers while, with two engines out, Caldwell single-handedly brought home his aircraft. This feat earned him the Air Force Cross.

This is an informative and exciting book.

*—Reviewed by Col. Alan L. Gropman, USAF, Deputy Director of Air Force Plans for Conceptual Development and Planning Integration, the Pentagon.*

## Rescue From Iran

*On Wings of Eagles,* by Ken Follett. William Morrow & Co., New York, N. Y., 1983. 444 pages. $16.95.

Ken Follett is best known for such fictional thrillers as *Eye of the Needle.* In this, his first nonfiction work, he describes the rescue in 1978 of two Americans from an Iranian prison by an amateur commando team.

The story begins with the arrest of the two Americans in the troubled Iranian capital city of Tehran. Paul Chiapparone and Bill Gaylord were employed by the Dallas-based Electronic Data Systems Corp. under contract to the Shah's government.

While no charges were ever filed against them, the two imprisoned Americans experienced constant interrogation and harassment by a vindictive Iranian bureaucrat who finally set "bail" of $12 million for their release.

This blatant blackmail attempt sparked a chain reaction within EDS's corporate headquarters in Dallas that led to the intervention of the company's chairman, Ross Perot.

When Perot's efforts to free the two

men through diplomatic channels came to naught, he decided on an independent course. From his executive staff, seven volunteers stepped forward to form a rescue team. To lead these "eagles"—for "men who got things done"—Perot chose retired Green Beret Col. "Bull" Simons of World War II and Vietnam fame.

Although some sketchy information on the situation in Tehran was derived from telephone contact with loyal EDS employees still in Iran, this intelligence source was never followed up because of the danger of alerting the authorities to the impending rescue operation.

As the team trained for the rescue attempt at a site near Dallas, members were fully aware of the unrest in the Mideast nation that led to revolution.

Assembling in Tehran, the team was confronted with escalating turmoil and Ayatollah Khomeini's supporters in the streets shooting, looting, and burning.

Ross Perot's loyal Iranian employees remained so during the upheaval. One in particular was the key to the actual rescue. He is camouflaged in the book under the pseudonym "Rashid" to protect his family, which remains in Iran today.

Rashid led a mob to the prison, overwhelmed the guards, and created enough confusion to allow the two captives to escape.

The "Dirty Team" then headed north toward the Turkish border in two Land Rovers. With Rashid's ingenious help, the EDS group was able to survive several dangerous encounters during this trek through the revolution-torn countryside.

Finally, to conclude this true adventure yarn, the group crossed the Turkish border to freedom on February 15, 1979.

*—Reviewed by Benjamin Catlin, AFA Assistant Executive Director for Defense Manpower.*

## New Books in Brief

*American Military Space Policy,* by Colin S. Gray. Defense analyst Gray, pointing out that "new technology may change dramatically the terms of strategic policy debate" and warning of "a crisis in US [space] policy direction," writes in this slim study that the world is near a "weaponization phase" in space. If this is so, then the US can no longer afford to consider space a sanctuary and must examine ways of protecting its interests beyond the atmosphere. The author suggests that arms-control agreements are too imprecise and complex to protect these interests, but calls for further study of arms-control issues as part of a renewed debate on space policy. Author Gray concludes by noting that "there may be a long-term trend favoring the defense over the offense" and endorsing heartily "the President's policy thrust toward strategic defense." With notes, appendices, and index. Abt Books, Cambridge, Mass., 1983. 128 pages. $28.

*Milestones of Flight,* by Michael J. H. Taylor and David Mondey. A singularly comprehensive chronology of aviation, this compilation should serve equally well as a reference for dates and facts for the student or professional or as an entertaining diversion for the enthusiast. The chronology spans the years from 863 B.C. to 1982 and is illustrated liberally throughout with prints and photos. In addition to the well-known "firsts," the authors have taken care to include in their listing all other significant aerospace events throughout history. Thus, the book's inclusiveness can reveal for the reader the broad panorama of the progress of aviation. With index. Published by Jane's, distributed in the US by Van Nostrand Reinhold Co., Boston, Mass., 1983. 288 pages. $17.95.

*The Military Officer's Guide to Better Communication,* by L. Brooks Hill with Maj. Michael R. Gallagher, USAF. The importance of clear and precise communication in the military has, of course, been long recognized and is attested to by the formal communication training available throughout the defense establishment. This book endeavors to bolster and enhance that training for the individual officer through practical guidance on such subjects as the communication process, the military communication environment, the process of military leadership, communication within the military, and military public relations. With charts, appendices, and index. Scott, Foresman and Co., Glenview, Ill., 1983. 130 pages. $7.95.

*Red Flag,* by Michael Skinner. This book on Tactical Air Command's world-famous series of air combat training exercises is not so much a comprehensive, detailed account as it is a spirited impression of what it is like out on the flight lines and in the cockpits as USAF's fighter pilots get their first ten "combat" missions under their belts. Red Flag exposes pilots from USAF and the sister services and allied air forces to the most realistic simulated combat conditions in the world. Author Skinner allows the Red Flag story to emerge from selected, interspersed commentary by participants and his own explanatory narrative. A fitting complement to the zestful text is George Hall's action photography of Red Flag operations. With maps. Presidio Press, Novato, Calif., 1984. 134 pages. $10.95.

*Red Flag Over Afghanistan,* by Thomas T. Hammond. On December 23, 1979, *Pravda* quoted Afghani Prime Minister Hafizullah Amin: "The Soviet Union . . . never has, and never will, violate [Afghanistan's] sovereignty and national independence." Four days later, on the night of December 27, Soviet troops stormed Amin's quarters in Kabul and killed him and his family. This scholarly work sketches the background leading to—and examines and analyzes in great depth—the Soviet invasion that accompanied that assassination. Author Hammond poses several persuasive explanations as to why the Soviets felt compelled to move so forcefully against this isolated, rugged nation, and speculates on possible Soviet actions to come. He concludes with four basic recommendations for US policy and action in the wake of the invasion and the changed geostrategic situation in Southwest Asia. With figures, notes, appendix, bibliography, and index. Westview Press, 5500 Central Ave., Boulder, Colo. 80301, 1984. 262 pages. $26.50 hardcover; $11.95 paper.

*Understanding U.S. Strategy: A Reader,* edited by Lt. Col. Terry L. Heyns, USAF. Based on 1982's Ninth National Security Affairs Conference sponsored by the National Defense University and the Office of the Assistant Secretary of Defense for International Security Affairs, this series of articles by an assortment of distinguished government and private-sector officials and scholars discusses the theme of "Evolving Strategies for a Changing World." In particular, five major topics are addressed: evolving a national strategy, strategies for Western Europe, strategies for the use of space, comparing US and Soviet strategies, and the US system for developing strategy. The resulting reader is an insightful survey of current trends in strategic thinking. With notes, figures and tables, and author biographies, and a foreword by then-NDU President Lt. Gen. John S. Pustay, USAF (since retired). Available from the Superintendent of Documents, GPO, Washington, D. C. 20402, 1983. 408 pages. $5.50.

*—Reviewed by Hugh Winkler, Assistant Managing Editor.*

# THE BULLETIN BOARD

By James A. McDonnell, Jr., MILITARY RELATIONS EDITOR

## Record VA Budget Request

The Veterans Administration's budget request for Fiscal Year 1985 is a "largest-ever" $27.2 billion. VA Administrator Harry Walters says it responds to the needs of the nation's 28,200,000 veterans and calls it "the first that reflects my personal views." Rep. G. V. "Sonny" Montgomery (D-Miss.), Chairman of the House Committee on Veterans Affairs, characterizes it as "one of the best we've had in several years," but with the caveat "there are two or three items that greatly concern me."

The request will fund a net increased staffing of some 2,000 slots, new medical facilities, additional medical work loads, increased medical research, an ambitious construction schedule, and higher compensation and pension payments. The construction program aims at beginning work on five major hospital replacement and modernization projects at Allen Park, Mich., Augusta, Ga., Houston, Tex., Mountain Home, Tenn., and New York, N. Y. Seven more nursing home units around the country are also contemplated.

Administrator Walters estimates that some $10 billion will be needed for compensation for about 3,000,000 veterans with service-connected disabilities and for survivors of veterans who died of service-connected causes. He anticipates that some $4 billion in pension payments based on financial need will be made to 732,000 wartime veterans and 817,700 survivors of wartime veterans.

Representative Montgomery has expressed concern that the budget does not fund the Emergency Veterans' Job Training Act in FY '85 *(see related item in November '83 "Bulletin Board")*, that it proposes a reduction of 800 employees in the Department of Veterans Benefits, and that it provides, in his view, "inadequate funding for outpatient treatment." Walters responded to these concerns during congressional hearings by noting that "with the economy improving and more Vietnam veterans working, hopefully we will not need to . . . continue the Emergency Job Training Act into 1985." He pledged, however, to come back for supplemental funds if necessary.

Concerning some other misgivings voiced by Congressman Montgomery and the committee, Walters says he believes the personnel cuts in some departments—a recommendation originally put forth by the Grace Commission—will work without a cutback in service. On the outpatient issue, no agreement was reached. VA believes that its proposed budget for the Department of Medicine and Surgery—$9.1 billion, or thirty-three percent of the entire VA request—is enough to meet the projected increase of about 18,000,000 outpatient visits.

Congressman Montgomery says that a survey conducted by his committee indicates the proposed funding is insufficient to meet the anticipated demand that is expected to grow primarily because of the aging of the veteran population. Undoubtedly, more will be heard about this issue as the proposed budget moves through the legislative process.

Other highlights of the 1985 fiscal blueprint:

Although more patients will be treated in-hospital, the average daily census of hospital patients is expected to decrease about twenty percent due in part to a trend toward shorter lengths of stay occasioned by more nursing-care options and increased ambulatory care. Burial activity at national cemeteries is projected to rise—a new facility will open this year at Fort Custer, Mich., and work on another will begin at Fort Mitchell, Ala. Also, greater use of automatic data-processing techniques, leading to improved veterans appeal response time, is forecast.

## Civilian Employees Honored

Air Force civilian employees worldwide were recently cited for a variety of outstanding efforts.

Four Outstanding Air Force Civilian Personnel Program Manager/Specialists have been named for accomplishments in 1983. These awards—the top Air Force recognition in this category—went to:

- Steve N. Smith, Civilian Personnel Officer at Kelly AFB, Tex., who accomplished a dramatic reduction in the time required to fill recruited vacancies and who also established an innovative training program.
- William E. Williams, Supervisory Personnel Staffing Specialist, Charleston AFB, S. C., who designed new and innovative methods to enhance the staffing process.
- Jeffrey A. Krouse, Edwards AFB, Calif., Personnel Staffing Specialist, who, among other accomplishments, improved management of college recruiting and cooperative education programs.
- Natalie M. Wright, of Yokota AB, Japan, who substantially improved the local recruitment process for DoD Dependent Schools.

Mr. Smith was named Outstanding Senior Program Manager; Mr. Williams, Outstanding Intermediate Program Manager; Mr. Krouse, Outstanding Intermediate Program Specialist; and the Outstanding Program Specialist Award was captured by Ms. Wright. All Air Force civilian employees GS-7 through GS/GM-15 who are either managers or specialists in the civilian personnel program were eligible for the honors.

Finally, Clarence Mohica, a radio operations supervisor with the 1957th Communications Group, Hickam AFB, Hawaii, became the first Air Force employee ever to win the Congressional Award for Exemplary Service to the Public.

Established in 1981, the award recognizes and underscores the interest of the President and Congress in the importance of courtesy throughout the government. Selected as one of three winners by US Office of Personnel Management Director Donald J. Devine from among seventy-three nominees from forty-one government departments and agencies, Mohica won for "going not only the extra mile" but the extra "thirty miles" through heavy rains and high winds when Hawaii was hit by the worst hurricane in more than twenty years.

Mohica traveled that distance to set up communications linking Bellows

AFS and Hickam AFB with the Hawaii Civil Defense System and the island of Kauai. The comm links relayed critical weather information. The eighteen-year Civil Service veteran was cited later by Maj. Gen. Robert F. McCarthy, Commander of the Air Force Communications Command, for "his special actions during the onslaught of Hurricane Iwa."

The storm also caused an underwater avalanche that severed the single comm cable to Johnston Island, a military installation 750 miles southwest of Honolulu. Mr. Mohica established high-frequency voice communications from the outset and later devised a method for radio teletype to be used. This was the only communication link to Johnston for the Air Force, Army, and Defense Nuclear Agency, and for the civilians on the island to the outside world for several months.

Also, in the spirit of dedication underlying his service, Mr. Mohica provided morale and welfare messages between the island and relatives on the mainland after duty hours, processing more messages through his facility in one month than the heavy traffic loads experienced during the Vietnam War. OPM Director Devine summed up Mohica's contributions as "an inspiration to civil servants throughout the country, providing an example of the very best of public service."

## CHAMPUS News Notes

CHAMPUS is considering a rule change that would allow heart patients to have their pacemakers monitored by telephone, with CHAMPUS sharing the cost of the service. This would permit doctors to find out whether a pacemaker is working properly without requiring the patient to make an unnecessary trip to the doctor's office. CHAMPUS is expected to announce soon whether or not they will cost-share this service.

CHAMPUS officials are also concerned that many military retirees are unaware that there is no "cap," or upper limit, on the dollar amount of the twenty-five percent cost-share the patient must pay when receiving care under CHAMPUS. In other words, if a military retiree gets covered care worth $20,000, his share is twenty-five percent, or $5,000. If the total care cost is $50,000—not at all unusual for some operations and attendant care—the retiree's cost is still twenty-five percent or, in this case, $12,500.

The bottom line, suggests CHAMPUS, is for eligible CHAMPUS beneficiaries to consider private CHAMPUS supplemental insurance policies offered by some military associations—AFA has a good one, for example—that will pay these residual costs. Otherwise, families could find their savings wiped out even though the treatment was CHAMPUS-covered.

Finally, CHAMPUS officials pass along this tip to those checking on a claim, regardless if you're checking with your claims processor, with CHAMPUS headquarters, or with your local Health Benefits Advisor. It will speed the checking process considerably, they note, if you have the following information at hand before calling: patient's full name; sponsor's full name, rank, branch of service, and status (active or retired); sponsor's Social Security number; sponsor's and patient's addresses and telephone numbers; name and address of whoever provided the care; and the dates of the care. Such advance preparation will speed your inquiry process considerably.

## Weber Brothers ANG Stalwarts

The recent retirement of SMSgt. John R. Weber from the Delaware Air National Guard, with more than thirty-three years of service, was a convenient point in time to total up the contributions of the four Weber brothers to the military. It turns out that, altogether, John, Burt, Clark, and Calvin Weber *(see photo)* have a combined 119 years of military service. If you include children and in-laws, the Weber family has contributed more than 150 years of military dedication!

MSgt. Calvin Weber has twenty-seven years of service, twenty-one as an air technician with the Delaware ANG. He's a Material Storage and Distribution Technician. SMSgt. Clark Weber has twenty-nine years of military service—twenty-six as a Delaware ANG air technician. He's now a Supply Systems Analyst, but was previously a C-97 loadmaster. Clark has two brothers-in-law, TSgt. Richard Ferrera and SSgt. Richard Till, who add twenty-two years of service to the family total.

MSgt. Burton Weber has thirty years of military service, including eight with SAC and twenty-one as a technician. He presently serves the DelANG as a Fabrication and Parachute Supervisor.

Finally, there's John, the first to enlist and the first to retire. SMSgt. John Weber has been in three career fields, starting as an aircraft mechanic. For the last nine years, he has been an air transportation superintendent with the Dover AFB aerial port. He flew for more than twelve years as a flight engineer, including Vietnam service. John's son—John W.—served six years with the Delaware ANG; his stepdaughter, Mari Lawrence, has been a member for the last three years.

AFA salutes the Webers of the Delaware ANG!

***The Webers of the Delaware ANG have a combined total of 119 years of military service. From left: Calvin, Burt, John, and Clark. See item.***

## USAF Budget Focuses On People

The President's FY '85 budget request was released early in February. From that, and from testimony before Congress by both Secretary of the Air Force Verne Orr and Air Force Chief of Staff Gen. Charles Gabriel, it is apparent that people are very much on budget-planners' minds.

Secretary Orr told lawmakers that he thinks the Air Force's recruiting and retention efforts are a success story *(see related item in March '83 "Bulletin Board")*, but that he is concerned with the drop in the number of people now coming into recruiting offices. He also deplored the constant talk about changes to the military retirement system. He noted that such speculation is highly unsettling to the military professional who believes the

present retirement system is part of an Air Force "contract" for service. The Secretary also voiced his concern with the need to improve Air Force quality of life by alleviating the current monetary penalties imposed on members going PCS.

General Gabriel told Congress that his number-one priority is people—"they give us the edge"—and lauded the contributions of the reserve forces to the overall Air Force readiness picture.

Overall, the Administration's budget request contains good news and bad news for the military/civilian employee family. On the one hand, it calls for a military pay raise of 5.5 percent and a Civil Service increase of 3.5 percent, both effective on January 1, 1985. On the other hand, it contains a proposal to shift COLA increases for both military and civilian retirees to January 1985, with subsequent increases coming every January. This would mean a delay of some seven months for the next regularly scheduled May 1, 1984, COLA upgrade.

The budget document notes that military retirement changes have been proposed by the Fifth Quadrennial Review of Military Compensation. These changes are currently being reviewed, and "it is anticipated that legislation will be forwarded to Congress upon completion of this review." While it was still uncertain at press time exactly what recommendations the QRMC has made, it was fairly certain that the recommendations will call for a reduction in current benefits.

On the civilian side of the house, the requested budget calls for increasing both individual and agency Civil Service retirement contributions from seven percent to eight percent in 1985 and to nine percent in 1986. It also bases annuity calculations on the "high-five" years of earnings instead of the current "high-three." Employees who are retirement-eligible or within three years of retirement eligibility would be grandfathered for the "high-three."

***CAP's Great Lakes Region Team won the 1983 USAF Chief of Staff Sweepstakes Trophy during the National Cadet Competition. See item. (USAF photo by SSgt. Randy McNatt)***

# THE BULLETIN BOARD

## CAP Holds Cadet Competition

The 1983 Civil Air Patrol National Cadet Competition was held at Maxwell AFB, Ala., during the week between Christmas and New Year's Day. The winner of the USAF Chief of Staff Sweepstakes Trophy, symbolic of overall excellence, was the Great Lakes Region Team *(see photo).* Cadet Donna S. Jones, Team Captain of the Southwest Region, captured the Outstanding Cadet Award.

Eight sixteen-member teams spent two days competing for the national championship. They competed in drill, one-mile run, and volleyball, took a written examination, and then participated in a panel quiz similar to the "College Bowl" that used to grace the TV screen. The purpose of the annual event is to stimulate interest in CAP's cadet program and to recognize those who have excelled in that program.

CAP, the official USAF auxiliary, boasts some 68,000 members and is widely recognized for its search and rescue activities, part of its Emergency Services Mission. It has some 26,000 teenage members in the Cadet Program, which includes encampments, training, and personal development activities.

## Bills by the Pound—Laws by The Ounce

Each congressional session sees literally thousands of bills introduced, discussed, lauded, deplored, and perhaps voted on. From all of this activity, the total number of bills actually signed into law runs to about 500 or so.

The Ninety-eighth Congress has been no exception and, as it moves toward its windup, probably before this year's elections, it's perhaps instructive to look at some of the many proposed bills that would affect military people or veterans if enacted. While lightning could strike and some of these might wind up on the President's desk for signature by year's end, knowledgeable observers of the Capitol Hill scene see generally little likelihood of this happening. Still, if you like the bill, you might want to thank its author.

Rep. Bill Archer (R-Tex.) wants to amend the IRS laws to exempt "from federal income taxes members of the armed forces of the United States who die as a result of hostile actions overseas." Sen. David L. Boren (D-Okla.) has introduced legislation to authorize a pension of $150 a month for World War I veterans and their surviving spouses. (Some 200 representatives have also sponsored such a bill in the House.) Senator Boren notes that these veterans are "few in number and . . . it is appropriate to demonstrate our concern and compassion for these veterans while we still have the time to do so." According to VA figures, there are indeed just about 300,000 World War I vets still alive.

Rep. Leon Panetta (D-Calif.) would like to encourage states to establish and operate veterans' service offices. These offices would provide veterans with advice and assistance concerning both state and federal veterans programs. Actually, many states, including California, already have a network of state or county veterans offices. It may be a good idea, but it's doubtful that the Administration would support giving federal money to a program that many states have already decided to fund on their own.

Rep. Dan Mica (D-Fla.) has introduced a bill that would authorize the VA to furnish to each veteran who is drawing compensation for a service-connected disability all drugs and medicines prescribed by a doctor for treatment of that disability. Again, for service-disabled veterans—although, in this case, with a requirement for at least a rating of fifty percent disabled—Rep. Bob Edgar (D-Pa.) would like to see outpatient dental care provided. The current burial allowance for veterans of $150 would rise to $250 if a bill introduced by Rep. Richard Shelby (D-Ala.) became law.

All in all, lots of activity—but probably little action in these areas.

## Short Bursts

The honor of being the **first Air National Guardsman to go into space**—on last December's Shuttle mission—belongs to **ANG Maj. Byron K. Lichtenberg,** an A-10 pilot with the 104th Tactical Fighter Group of the Massachusetts Air Guard. Lichtenberg, a mission payload specialist on the Shuttle, carried an Eagle-in-Gear flag—symbolic of employer support of Guard and Reserve programs—into orbit.

The VA will establish two more **Geri-**

**atric Research Education and Clinical Centers**—at Durham, N. C., and Gainesville, Fla.—bringing to ten the number of these Centers of excellence in the study of and care for the aging. Each GRECC focuses on a particular area of geriatrics. Durham's will specialize in oncology and cardiovascular disease while the Gainesville facility will zero in on geropharmacology.

If you really want to know what time it is, you'll be interested to learn that the **US Naval Observatory,** the nation's official timekeeper, has expanded direct-dial service to its master clock. Anyone in the US can now **call 1-900-410-TIME** for only fifty cents for the first minute and thirty-five cents for each additional minute.

Remember **Skitch Henderson?** He's now Conductor-Director of the New York Pops Orchestra and has just been named the 1984 recipient of **Zonta International's Amelia Earhart Award** for his efforts on behalf of the US Air Force Reserve. Also participating in the tribute are the Wings Club of New York and the Ninety-Nines, a national organization of women pilots whose founding president was Amelia Earhart.

King for a year—of Bocket, Germany, that is—is the honorary title recently bestowed on Air Force **MSgt. Edward Saunders,** an airborne radar technician assigned to the NATO Airborne Early Warning Force. He lives in Bocket and won the annual village shooting match—the kingship goes along with that. His wife, Louise, automatically becomes the queen.

The Veterans Administration is now accepting applications for its **1984–85 Health Professional Scholarship Program.** Prospective registered nurses who will agree to work full-time for VA for at least two years after graduation can get tuition, educational expenses, and a monthly stipend. Those interested may contact the VA Scholarship Program Office, DM&S (14N), 810 Vermont Ave., Washington, D. C. 20420. The application deadline is June 1, 1984.

Sign of the times—the Military Wives Association has changed its name to **National Military Families Association.** Men may now become members.

Air Force retirees and family members who have **paid advance greens fees at any Air Force golf course** may play at any other at least sixty miles from the course where the advance fees were paid. Just present an ID card and evidence of fee payment—usually a membership card with an expiration date. Details are in AFR 215-19.

**Capt. Steve Pecinovsky,** Assistant Staff Judge Advocate at the USAFA, established the second fastest time in American race walking history when he won the **Athletic Congress National Three Kilometer Race Walking Championships** recently in Boston, Mass. His winning time—11:42. The American record is 11:35.

**Marriott Hotels** are offering **special rates** for government and military employees—active, retired, and reserve as well as federal, state, and local government employees and accompanying family members—traveling on business or pleasure. A free "1984 Government and Military Vacation Guide," giving details, is available from Marcia Roitman, P. O. Box 8328, Rockville, Md. 20856.

Thirty-five years ago, the present **Air Force blue uniform** was adopted. Earlier, a variation of the Army brown uniform was used. Interestingly, six out of ten of today's Air Force officers weren't even born then. ■

# SENIOR STAFF CHANGES

**PROMOTIONS:** To be **Brigadier General:** Jimmie V. **Adams;** Joseph W. **Ashy;** Loring R. **Astorino;** Robert H. **Baxter;** Malcolm F. **Bolton,** Jr.; Charles G. **Boyd;** Stuart R. **Boyd;** Edward R. **Bracken;** Denis M. **Brown;** George L. **Butler;** Harold N. **Campbell;** Richard E. **Carr;** David M. **Cornell;** Hugh L. **Cox** III; Richard L. **Craft;** Philip M. **Drew;** David B. **Englund;** Larry D. **Fortner;** James E. **Freytag;** Richard B. **Goetze,** Jr.; Frank S. **Goodell;** Richard E. **Hearne;** William L. **Hiner;** Frank B. **Horton** III; John E. **Jaquish;** Frank J. **Kelly,** Jr.; Robert H. **Ludwig;** Joel M. **McKean;** Raymond V. **McMillan;** Eric B. **Nelson;** Keithe E. **Nelson;** Donald A. **Rigg;** Martin J. **Ryan,** Jr.; John P. **Schoeppner,** Jr.; John **Serur;** Garryl C. **Sipple;** Richard D. **Smith;** Donald **Snyder;** Dale C. **Tabor;** Earl S. **Van Inwegen;** Henry **Viccellio,** Jr.; Charles A. **Vickery;** Frank E. **Willis;** Charles P. **Winters;** Mark J. **Worrick.**

**RETIREMENTS:** M/G George A. **Edwards,** Jr.; M/G Donald L. **Evans;** B/G Raymond C. **Preston,** Jr.; B/G Rudolph F. **Wacker.**

**CHANGES: Col. (B/G selectee) Jimmie V. Adams,** from Dep. Dir. for Ops. & Training, DCS/P&O, Hq. USAF, Washington, D. C., to Spec. Ass't for Tactical Modernization, DCS/RD&A, Hq. USAF, Washington, D. C. . . . **B/G Michael H. Alexander,** from Dep. for Strategic Sys., ESD, AFSC, Hanscom AFB, Mass., to Joint Prgm. Mgr., WWMCCS Info. Sys., Hq. USAF, Washington, D. C., replacing retired M/G Donald L. Evans . . . **Col. (B/G selectee) Loring R. Astorino,** from Cmdr., 93d Bomb Wg., SAC, Castle AFB, Calif., to Cmdr., 19th AD, SAC, Carswell AFB, Tex., replacing retiring B/G Rudolph F. Wacker . . . **B/G (M/G selectee) Thomas C. Brandt,** from DCS/Intel., Hq. SPACECOM, Peterson AFB, Colo., to Chief, Joint Planning Staff for Space, OJCS, Washington, D. C.

**Col. (B/G selectee) David M. Cornell,** from DCS/Engineering & Services, Hq. MAC, Scott AFB, Ill., to DCS/Engineering & Services, Hq. AFLC, Wright-Patterson AFB, Ohio, replacing retired B/G William M. Shaw, Jr. . . . **B/G (M/G selectee) Archer L. Durham,** from Vice Cmdr., Hq. Mil. Traffic Mgmt. Command, Washington, D. C., to Dir., J-5, & IG, Hq. USREDCOM, MacDill AFB, Fla., replacing retired M/G George A. Edwards, Jr. . . . **Col. (B/G selectee) Larry D. Fortner,** from Cmdr., 2d Bomb Wg., SAC, Barksdale AFB, La., to Cmdr., 42d AD, SAC, Blytheville AFB, Ark., replacing B/G Donald L. Marks . . . **Col. (B/G selectee) Richard B. Goetze, Jr.,** from Chief, Strategic Ops. Div., J-3, OJCS, Washington, D. C., to Cmdr., 40th AD, SAC, Wurtsmith AFB, Mich.

**B/G Wayne O. Jefferson, Jr.,** from Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., to Dep. Dir. for $C^3$ Connectivity & Eval., OJCS, Washington, D. C. . . . **B/G Donald L. Marks,** from Cmdr., 42d AD, SAC, Blytheville AFB, Ark., to Ass't DCS/Ops., Hq. SAC, Offutt AFB, Neb., replacing B/G Wayne O. Jefferson, Jr. . . . **B/G Fred R. Nelson,** from Cmdr., 20th TFW, USAFE, RAF Upper Heyford, UK, to Dep. Dir. for Ops., Nat'l Mil. Command Sys., OJCS, Washington, D. C., replacing M/G Maurice C. Padden . . . **Col. (B/G selectee) Keithe E. Nelson,** from Dir., USAF Judiciary, Hq. AFLSC, Washington, D. C., to Staff Judge Advocate, Hq. SAC, Offutt AFB, Neb., replacing B/G (M/G selectee) Robert W. Norris.

**Col. (B/G selectee) Dale C. Tabor,** from Cmdr., 81st TFW, USAFE, RAF Bentwaters, UK, to IG, Hq. USAFE, Ramstein AB, Germany, replacing B/G Cecil W. Powell . . . **B/G Norman R. Thorpe,** from Staff Judge Advocate, Hq. USAFE, Ramstein AB, Germany, to Staff Judge Advocate, Hq. AFLC, Wright-Patterson AFB, Ohio . . . **Col. (B/G selectee) Frank E. Willis,** from Cmdr., 317th TAW, MAC, Pope AFB, N. C., to Vice Cmdr., Hq. AFMPC, & Dep. Ass't DCS/M&P for Mil. Personnel, Randolph AFB, Tex., replacing B/G Robert L. Rutherford.

**SENIOR ENLISTED ADVISOR CHANGES: CMSgt. Donald V. Tate,** to SEA, Hq. AFTAC, Patrick AFB, Fla., replacing retired CMSgt. James B. Payne . . . **CMSgt. Herman F. Thompson,** to SEA, Hq. AAC, Elmendorf AFB, Alaska, replacing CMSgt. Jimmie B. Lavender. ■

# First of the Few

## On his first combat mission, Sgt. Maynard Smith earned a unique place in the Air Force heritage of valor.

**BY JOHN L. FRISBEE**

EIGHTH Air Force bombers and fighters began arriving in England during the spring of 1942. The first heavy bomber mission against targets in Occupied Europe was flown on August 17, 1942. Maj. Gen. Ira Eaker, head of VIII Bomber Command and soon to lead the Eighth Air Force, had high hopes of sending massive formations against the Luftwaffe and Germany's war-supporting industry before the end of the year. That was not to be.

The buildup of men and planes was slower than anticipated. Half of Eaker's force was sent to North Africa in late 1942 and early '43, and what was left in England was frequently diverted in a fruitless campaign against German submarine pens along the Bay of Biscay on the west coast of France. The pens, with their eleven-foot-thick reinforced concrete roofs, were impervious to any bombs the AAF had at that time, and were heavily defended by antiaircraft guns and fighters.

On May 1, 1943, Sgt. Maynard Smith, a B-17 ball-turret gunner known to his friends as "Snuffy," participated in a memorable strike against the pens at Saint-Nazaire, familiar to bomber crews as Flak City. He was assigned to the 423d Squadron of the 306th Bombardment Group, one of the Eighth's battle-tested outfits, based at Thurleigh. Smith enjoyed two distinctions: As a replacement, he was on his first combat mission, and at age thirty-two he was ten years older than most of the rest of the crew.

Shortly after bombs-away, Smith's B-17 was hit repeatedly by flak and cannon fire from FW-190s. The oxygen system and intercom were shot out, and intense fires broke out in the radio compartment and waist section. The situation became so critical that the waist gunners and radio operator bailed out into the sea. The tail gunner had been hit in the chest by shell fragments and was in serious condition.

Smith decided to stay with the plane, tend to the tail gunner as best he could, and fight the fire. He was isolated from the crew up front and at first did not know whether they had bailed out or been killed, but since the B-17 seemed to be holding formation, he assumed that the pilot, at least, was alive and at the controls.

*On July 15, Maynard "Snuffy" Smith, by then a staff sergeant, received the Medal of Honor from Secretary of War Henry L. Stimson.*

As long as the fighter attacks continued, Smith alternated between manning the waist guns, fighting the fire, and helping the tail gunner. When heat in the radio compartment began to detonate machine-gun ammunition, he threw exploding .50-caliber belts out through a hole burned in the side of the fuselage.

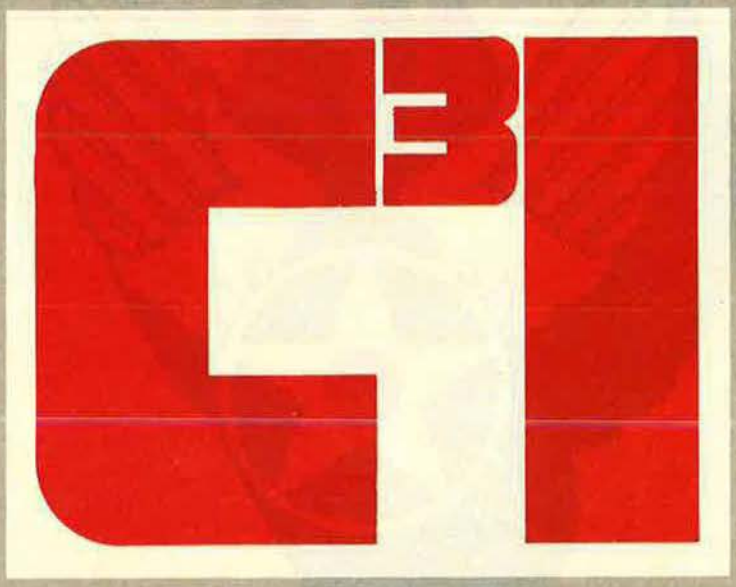
The attacks by fighters finally stopped, and Smith concentrated on the fire. When all extinguishers were empty, he wrapped himself in protective clothing and put out the fire with his hands. Then, fearing that the heat had weakened the B-17's fuselage, the short, slight Smith threw out everything in the rear of the plane that wasn't too hot, too heavy, or bolted down. With a heroic assist from Snuffy Smith, the battle-scarred Fortress made it across the Channel to a landing near Land's End, the extreme southwest tip of England. That B-17 had flown its last mission.

Six weeks later, Sgt. Maynard H. Smith was awarded the Medal of Honor, the first enlisted airman ever to win the nation's highest decoration. He is one of only five enlisted airmen—four in World War II and one in Vietnam—to be so honored.

After the Saint-Nazaire strike, Sergeant Smith flew five more missions before being grounded. By that time, the submarine menace had faded, some of the pens had been blown up by rudimentary guided glide bombs, and the Air Force acknowledged that further attacks would be a waste of effort.

Those superhardened, heavily defended targets had tested the skill and bravery of many airmen, among them a small but courageous sergeant who was first of the few among his peers to wear the Medal of Honor. ■

# ELECTRONICS AND THE AIR FORCE




## Major Developments and Their Impact on Military Plans and Operations

A National Symposium of the Air Force Association
Hilton at Colonial, Wakefield, Mass. (near Hanscom AFB on Route 95/128)
April 26–27, 1984

An authoritative overview of the importance of electronics to the Air Force with special emphasis on C³I developments and their impact on military plans and operations. Participants will include senior officials and advisors from the Administration, the Defense Department, and the Air Force. The Symposium will be held in conjunction with the Air Force Systems Command. This will be an excellent opportunity to hear ranking experts examine and analyze the challenges and prospects of C³I and electronic warfare, especially the relation between hardware and operations. In a larger sense, the Symposium will probe potential changes in strategic and conventional warfare doctrine that suggest themselves as a result of revolutionary growth in C³I and electronic warfare technology.

**SPEAKERS INCLUDE:**

**Keynoter**
**Lt. Gen. James W. Stansberry, USAF**
Commander, Electronic Systems Div., AFSC

**Dinner Speaker**
**Mr. James Woolsey**
Former Under Secretary of the Navy
Member of Scowcroft Commission

**Dr. Richard D. DeLauer**
Under Secretary of Defense for Research and Engineering

**Gen. Robert T. Marsh, USAF**
Commander, Air Force Systems Command

**Gen. James P. Mullins, USAF**
Commander, Air Force Logistics Command

**Mr. Harold Kitson**
Deputy Assistant Secretary of the Navy for C³I

**Mr. Martin F. Chen**
Principal Deputy Assistant Secretary of the Air Force for Research, Development, and Logistics

**Lt. Gen. Robert T. Herres, USAF**
Director, Command Control & Communications Systems, OJCS

**Lt. Gen. Thomas H. McMullen, USAF**
Commander, Aeronautical Systems Div., AFSC

**Lt. Gen. Robert C. Kingston, USA**
Commander in Chief, US Central Command

**Brig. Gen. John P. Hyde, USAF**
Deputy Chief of Staff, Communications and Electronics, SPACECOM

**Col. Donald "Desi" Arnaiz**
Deputy Chief of Staff, Intelligence, TAC

Registration fee for all Symposium events is $225 for AFA individuals and Industrial Associate members (all others $250). This fee includes presentation sessions, coffee breaks, continental breakfast, lunch, and a dinner with a major speaker. For information and registration, call Jim McDonnell or Dottie Flanagan at (202) 637-3300, Air Force Association, Suite 400, 1750 Pennsylvania Ave., N.W., Washington, D.C. 20006.

# PROTECTION!

## Diversified, effective, affordable insurance for our members and their families!

For more than thirty years, Air Force Association group insurance programs have made insurance protection available to AFA members and their families to assure them of a secure financial future.

With each passing year, these plans have grown in value and member participation. Today, nearly 50,000 AFA members are provided coverage under one or more of these programs.

**AFA members have these plans available to them:**

| AFA Group Life Insurance | AFA Cham*PLUS*® | AFA Hospital Indemnity Insurance | AFA Senior Age Medicare Supplement | AFA Worldwide Accident Insurance |
|---|---|---|---|---|
| Three strong plans provide up to $270,000 in coverage with waiver of premium and extra accidental death benefits. Coverage for family members is available on an optional basis. | A comprehensive CHAMPUS supplement program for eligible AFA members and their dependents. | Benefits up to $80 per hospital day for up to 12 months. Family plans and optional emergency hospital outpatient benefits are available. | Supplementary coverage to Medicare Parts A and B is available to members age 65 and over. | Benefits up to $250,000 are provided in case of accidental death. Additional benefits are also provided for expenses due to accidents. |

We invite you to call or write AFA for information about any of these programs, or for consultation on your insurance needs. There is no cost or obligation.

**Air Force Association**
**Insurance Division**
1750 Pennsylvania Ave., N.W., Washington, D.C. 20006

# Call toll free 800/424-5150

# AFA Intercom

*Oklahoma's contribution to AFA includes four National Presidents, more than from any other state. From left, current President David L. Blankenship, a native of Tulsa, Harold C. Stuart (1951–52), also from Tulsa, and Robert S. Johnson (1949–51), a native of Lawton, hold a photograph of fellow Sooner Jess Larson (1964–67), who hails from Chickasha. The occasion was Mr. Johnson's recent induction into the Oklahoma Aviation and Space Hall of Fame. (Photo courtesy of the Oklahoma Aviator)*

## Continued Growth Is the Goal as AFA Begins 1984 Membership Drive

Later this month, AFA chapters and state and regional organizations will kick off the 1984 Membership Drive. Although the official starting date is April 23, chapter, state, and regional membership chairmen as well as many other AFA members have already put in months of hard work in preparation for the drive.

The hard work will be needed if the 1984 drive is to be as successful as last year's. In 1983, two regional organizations, fifteen state organizations, and seventy-nine chapters achieved their membership goals. Additionally, eight of the Air Force's thirteen Major Commands and six of its fifteen Separate Operating Agencies set records for new-member recruitment.

For the twelve-month period ending June 30, 1984, chapter goals are as follows:

- *New* members equivalent to twenty percent of the chapter's total membership as of June 30, 1983 (or September 30, 1983, if lower).
- *Total* membership equivalent to 110 percent of the chapter's total membership as of June 30, 1983 (or September 30, 1983, if lower).

State goals are equivalent to the sum of individual chapter goals within the state, and regional goals are equivalent to the sum of individual state goals within the region. Regions, states, and chapters that meet these membership goals, established by AFA's Membership Committee, will be presented Membership Achievement Awards at the 1984 AFA National Convention.

AFA's 1984 Membership Committee is chaired by James M. McCoy (Nebraska) and includes Thomas O. Bigger (Tennessee), Robert L. Carr (Pennsylvania), Hugh L. Enyart (Illinois), Joseph R. Falcone (Connecticut), Dan D. Fulgham (Texas), H. B. Henderson (Virginia), Karen M. Kyritz (Colorado), Arthur L. Littman (California), Frank M. Lugo (Alabama), and Ellis T. Nottingham, Jr. (Virginia).

## AFA Chapters Benefit From Community Partner Program

Designed to enable community-based companies and professional offices to affiliate with the Air Force Association through the local AFA

*During ceremonies at the National Air and Space Museum in Washington, D. C., in January, Aerospace Education Foundation Trustee John V. Sorenson, right, was presented the National Aeronautic Association's prestigious Frank G. Brewer Trophy in recognition of his lifelong contributions to aerospace education and training. Pictured with Mr. Sorenson are famed test pilot A. Scott Crossfield and Mrs. Sorenson.*

chapter, AFA's Community Partner Program provides a source of both new members and additional funding for the chapter.

Initiated in 1979, the Community Partner Program has grown steadily. Thirty chapters participated in the program in 1983 *(see accompanying box).*

In return for an annual fee of either $50 (one member/patron) or $100 (two members/patrons), the organization is designated a Community Partner of AFA and is presented with a handsome, hand-lettered certificate.

Each person named by the organization to be an AFA member (or patron, depending upon eligibility) receives full membership privileges. More importantly, the Community Partner Program provides the chapter with an effective way to strengthen its ties with the local business community and at the same time to increase its income by retaining fifty percent of the affiliation fee.

For more information on the Community Partner Program, contact the Field Organizations Department at AFA National Headquarters.

### Participants in AFA's Community Partner Program

Abilene (Texas)
Airport Number One (Pennsylvania)
Alamo (Texas)
Anchorage (Alaska)
Central Florida (Florida)
Central Oklahoma (Oklahoma)
Chatauqua (New York)
Cleveland (Ohio)
Col. Stuart E. Kane, Jr. (Pennsylvania)
Colorado Springs/Lance Sijan (Colorado)
Daytona Beach (Florida)
Delaware Galaxy (Delaware)
Flatirons (Colorado)
Fort Wayne-Baer Field (Indiana)
Fresno (California)
Langley (Virginia)
Lehigh Valley (Pennsylvania)
Mid-Ohio (Ohio)
Nassau-Mitchel (New York)
Paso Del Norte (Texas)
Pope (North Carolina)
Rocky Mountain (Utah)
Silver & Gold (Colorado)
Spokane (Washington)
Spudland (Maine)
Swamp Fox (South Carolina)
Thunderbird (Nevada)
Union Morris (New Jersey)
Ute (Utah)
Wasatch (Utah)

## Public Affairs Reserve Squadron and AFA—The Common Thread

In several locations around the country, groups of active and retired Air Force Reservists are meeting regularly. Their purpose in getting together is to preserve the comradeship of the once very active Public Affairs Reserve Squadron (PARS) program.

The PARS program was created to support USAF's public affairs efforts. Squadron personnel, who were drawn primarily from advertising and public-relations agencies and the news media, worked individually and in teams to assist USAF Public Affairs Officers in a variety of endeavors—everything from writing and designing base guides to filling in for active-duty personnel who were on leave. At peak manning, the program consisted of 260 officers and enlisted personnel with another thirty Reservists attached, assigned to seven squadrons and twenty flights in major cities throughout the nation.

*The Air Force JROTC unit at Bolingbrook High School, Bolingbrook, Ill., captured first place in the essay category of the Aerospace Education Foundation's 1983 AFJROTC Contest. Proudly displaying the first-place plaque are essay coauthors Cadet Sgt. Valerie Spurney, left, and Cadet Lt. Mary Ostrowski. Fellow Illinois resident and AEF Trustee Richard H. Becker, right, AFA's 1983 Man of the Year, presented the plaque and $500 in prize money before a general assembly of the unit and school officials. The Unit Advisor is Maj. Norman Gallant, USAF (Ret.).*

*AFA's Reno Chapter in Nevada recently sponsored an honorary membership for Rep. Barbara F. Vucanovich (R-Nev.). Representative Vucanovich, who is an aircraft owner and a private pilot, was recognized for her support of USAF and aerospace programs. Presenting the certificate is Reno Chapter President Vernon Frye.*

*Brig. Gen. Charles A. Horner, center, Commander of the USAF Air Defense Weapons Center at Tyndall AFB, Fla., was the guest speaker at a recent meeting of AFA's Tallahassee Chapter. Pictured with General Horner are Ben Fuller, left, then Chapter President, and Lacey F. Moore, current Chapter President.*

Although the PARS program was terminated nearly three years ago, former members maintain "The Corps" by meeting to discuss their mutual interest in public affairs and the Air Force. But there is a common thread that extends beyond the PARS program—nearly all of these Reservists are now active AFA members.

Nowhere is the PARS influence more evident than in the Delaware Valley (Pennsylvania and New Jersey), where former members of the award-winning 9010th PARS banded together to form the New Jersey AFA Public Affairs Chapter. Jack Kruse, the former Commander of the 9010th PARS, was the Chapter's first President. Lacking an official public affairs function in the Air Force, these former PARS members lend their talents to the production of the New Jersey State AFA publication *Wingtips,* as well as the State Convention journal.

*During "Air Force Academy Day," held late last year in Winter Haven, Fla., John W. Dillin, left, President of AFA's Lake Region Chapter and a retired Air Force lieutenant colonel who has been an Admissions Liaison Officer (ALO) for the past twenty-four years, welcomed home (from left) C/4C Karen Milligan, C/3C John J. McGarrity, C/1C Ruth Deniston, C/1C Kevin Ashley, and C/1C Robert Polumbo. In his role as an ALO, Colonel Dillin helped all of the cadets to gain appointment to the Academy. In addition, he sponsored AFA memberships for the three C/1Cs. (Photo by C/1C Pete Hassett)*

Other AFA chapters also benefit from the talent and experience of these Reservists. In New York City, nearly eighty former members of the 9015th PARS are AFAers, the majority affiliated with the Iron Gate Chapter. In Chicago, a majority of the alumni of the 9014th PARS is affiliated with AFA's Scott Memorial Chapter. And in Miami, four AFA chapters count 9013th PARS alumni as members.

# Unit Reunions

**Jolly Green Rescue Forces**
The Jolly Green Rescue Forces' fifteenth annual reunion will be held on May 11–12, 1984, at the Ramada Inn in Fort Walton Beach, Fla. **Contact:** Ed Modica, 222 Sotir Ave., Fort Walton Beach, Fla. 32548. Phone: (904) 863-1959.

**Narsarssuak Air Base Ass'n**
The Narsarssuak Air Base (Greenland) Association's second reunion will be held on June 28–July 1, 1984, in San Antonio, Tex. **Contact:** Art Turner, 10218 Willowick Lane, San Antonio, Tex. 78217.

**2d Bomb Squadron**
Veterans of the 2d Bomb Squadron will hold a reunion at the Seapoint Hotel in San Diego, Calif., on June 14–17, 1984. **Contact:** Jim Bradley, 5803 N. W. 70th Ave., Fort Lauderdale, Fla. 33319. Phone: (305) 721-9262.

**2d Bomb Wing**
The 2d Bomb Wing will hold a reunion on May 11–13, 1984, in Savannah, Ga. **Contact:** Lt. Col. Lee Herridge, USAF (Ret.), 16975 Encino Hills Dr., Encino, Calif. 91436. Phone: (818) 986-4171.

**10th Fighter Squadron**
Members of the 10th Fighter Squadron, 50th Fighter Group, will hold a reunion in New Orleans, La., on July 1–4, 1984. **Contact:** B. B. Morrison, P. O. Box 1258, Riverdale, Ga. 30274. Phone: (404) 996-7253.

**26th Fighter Squadron**
The 26th Fighter Squadron, 51st Fighter Group "China Blitzers" will hold their reunion on June 21–23, 1984, at the Green Oaks Inn, Fort Worth, Tex. **Contact:** Charles Streit, 6416 Juneau Rd., Fort Worth, Tex. 76116. Phone: (817) 732-6407.

# AFA State Contacts

Following each state name, in parentheses, are the names of the localities in which AFA Chapters are located. Information regarding these Chapters, or any place of AFA's activities within the state, may be obtained from the state contact.

**ALABAMA** (Auburn, Birmingham, Huntsville, Mobile, Montgomery, Selma): **Jim Patterson,** 802 Brickell Rd., N.W., Huntsville, Ala. 35805 (phone 205-837-5087).

**ALASKA** (Anchorage, Fairbanks): **William M. Mack,** 2620 Karluk St., Anchorage, Alaska 99504 (phone 907-279-3270).

**ARIZONA** (Phoenix, Sedona, Sun City, Tucson): **Thomas W. Henderson,** 4820 N. Camino Real, Tucson, Ariz. 85718 (phone 602-299-6467).

**ARKANSAS** (Blytheville, Fayetteville, Fort Smith, Little Rock): **Aaron E. Dickerson,** 710 S. 12th, Rogers, Ark. 72756 (phone 501-636-7460).

**CALIFORNIA** (Apple Valley, Edwards, Fairfield, Fresno, Hermosa Beach, Los Angeles, Merced, Monterey, Novato, Orange County, Pasadena, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Jose, Santa Barbara, Santa Monica, Sunnyvale, Vandenberg AFB, Yuba City): **David Graham,** 29611 Vista Plaza Drive, Laguna Niguel, Calif. 92677 (phone 714-495-4622).

**COLORADO** (Aurora, Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Littleton, Pueblo, Waterton): **William R. Morris,** 5521 S. Telluride Court, Aurora, Colo. 80015 (phone 303-693-4464).

**CONNECTICUT** (East Hartford, North Haven, Storrs, Stratford, Westport, Windsor Locks): **Raymond E. Choquette,** 16 Tonica Springs Trail, Manchester, Conn. 06040 (phone 203-646-4818).

**DELAWARE** (Dover, Wilmington): **Joseph H. Allen, Jr.,** 537 Roberta Ave., Dover, Del. 19901 (phone 302-674-3472).

**DISTRICT OF COLUMBIA** (Washington, D. C.): **David J. Smith,** 1750 Pa. Ave., N. W., Suite 400, Washington, D. C. 20006 (phone 202-637-3346).

**FLORIDA** (Brandon, Cape Coral, Daytona Beach, Fort Walton Beach, Gainesville, Jacksonville, Leesburg, Naples, New Port Richey, Orlando, Panama City, Patrick AFB, Redington Beach, Sarasota, Tallahassee, Tampa, West Palm Beach, Winter Haven): **Morgan S. Tyler, Jr.,** 1776 6th St., N. W., Apt. 606, Winter Haven, Fla. 33880 (phone 813-299-2773).

**GEORGIA** (Athens, Atlanta, Columbus, Rome, Savannah, St. Simons Island, Valdosta, Warner Robins): **Thomas E. Farr,** 92 Brandon Ridge Drive, Atlanta, Ga. 30328 (phone 404-255-5213).

**GUAM** (Agana): **Joe Gyulavics,** P. O. Box 21543, Guam 96921 (phone 671-734-2369).

**HAWAII** (Honolulu): **Don J. Daley,** P. O. Box 3200, Honolulu, Hawaii 96847 (phone 808-525-6296).

**IDAHO** (Boise, Mountain Home, Twin Falls): **Stanley I. Anderson,** Box 45, Gowen Field, Boise, Idaho 83709 (phone 208-362-9360).

**ILLINOIS** (Belleville, Champaign, Chicago, Decatur, Elmhurst, Peoria): **Kyle Robeson,** 125 W. Church St., Champaign, Ill. 61820 (phone 217-352-3936).

**INDIANA** (Bloomfield, Fort Wayne, Indianapolis, Lafayette, Logansport, Marion, Mentone, South Bend): **John Kagel,** 1029 Riverside Drive, South Bend, Ind. 46616 (phone 219-234-8855).

**IOWA** (Des Moines): **Carl B. Zimmerman,** 608 Waterloo Bldg., Waterloo, Iowa 50701 (phone 319-232-2650).

**KANSAS** (Topeka, Wichita): **Cletus J. Pottebaum,** 6503 E. Murdock, Wichita, Kan. 67206 (phone 316-683-3963).

**KENTUCKY** (Lexington, Louisville): **Carl D. Black,** 11500 Redwood Way, Anchorage, Ky. 40223 (phone 502-245-7697).

**LOUISIANA** (Alexandria, Baton Rouge, Bossier City, Monroe, New Orleans, Shreveport): **James P. LeBlanc,** 5905 Flagler St., Metairie, La. 70003 (phone 504-887-8524).

**MAINE** (Bangor, Limestone, N. Berwick): **Arley McQueen, Jr.,** Route 1, Box 215, Wells, Me. 04090 (phone 207-676-9511, ext. 2354).

**MARYLAND** (Andrews AFB area, Baltimore): **William L. Ryon, Jr.,** 8711 Liberty Lane, Potomac, Md. 20854 (phone 301-299-8717).

**MASSACHUSETTS** (Bedford, Boston, Falmouth, Florence, Hanscom AFB, Lexington, Taunton, Worcester): **John F. White,** 49 West Eagle St., East Boston, Mass. 02128 (phone 617-567-1592).

**MICHIGAN** (Battle Creek, Detroit, Kalamazoo, Marquette, Mount Clemens, Oscoda, Petoskey, Southfield): **Robert J. Schaetzl,** 42247 Trotwood Court, Canton, Mich. 48187 (phone 313-552-3280).

**MINNESOTA** (Duluth, Minneapolis-St. Paul): **Edward A. Orman,** 368 Pike Lake, Duluth, Minn. 55811 (phone 218-727-8381).

**MISSISSIPPI** (Biloxi, Columbus, Jackson): **Clarence Ball, Jr.,** 5813 David Davis Pl., Ocean Springs, Miss. 39564 (phone 601-875-5883).

**MISSOURI** (Kansas City, Knob Noster, Springfield, St. Louis): **James R. Hopkins,** 316 Hillcrest Drive, Warrensburg, Mo. 64093 (phone 816-747-6087).

**MONTANA** (Great Falls): **John Phillips,** P. O. Box 685, Great Falls, Mont. 59403 (phone 406-761-3989).

**NEBRASKA** (Lincoln, Omaha): **Edward A. Crouchley,** 1314 Douglas On the Mall, Omaha, Neb. 68102 (phone 402-633-2125).

**NEVADA** (Las Vegas, Reno): **William J. Becker,** 1709 Valmora, Las Vegas, Nev. 89102 (phone 702-873-5945).

**NEW HAMPSHIRE** (Manchester, Pease AFB): **Robert N. McChesney,** Scruton Pond Rd., Barrington, N. H. 03825 (phone 603-664-5090).

**NEW JERSEY** (Andover, Atlantic City, Belleville, Camden, Chatham, Cherry Hill, E. Rutherford, Forked River, Fort Monmouth, Jersey City, McGuire AFB, Middlesex County, Newark, Old Bridge, Trenton, Wallington, West Orange, Whitehouse Station): **Frank Kula,** 264 Edgewood Drive, Toms River, N. J. 08753 (phone 201-244-2491).

**NEW MEXICO** (Alamogordo, Albuquerque, Clovis): **Louie T. Evers,** P. O. Box 1946, Clovis, N. M. 88101 (phone 505-762-1798).

**NEW YORK** (Albany, Brooklyn, Buffalo, Chautauqua, Garden City, Hempstead, Hudson Valley, New York City, Niagara Falls, Plattsburgh, Queens, Rochester, Rome/Utica, Southern Tier, Staten Island, Suffolk County, Syosset, Syracuse, Westchester): **Robert E. Holland,** 750-75A Lido Blvd., Lido Beach, N. Y. 11561 (phone 516-889-1571).

**NORTH CAROLINA** (Asheville, Charlotte, Fayetteville, Goldsboro, Greensboro, Kitty Hawk, Raleigh): **Hal Davis,** 1034 Manchester Drive, Cary, N. C. 27511 (phone 919-467-6511).

**NORTH DAKOTA** (Concrete, Fargo, Grand Forks, Minot): **James M. Crawford,** 1720 9th St., S. W., Minot, N. D. 58701.

**OHIO** (Akron, Cincinnati, Cleveland, Columbus, Dayton, Newark, Youngstown): **Charles B. Spencer,** 333 West 1st St., Suite 252, Dayton, Ohio 45402 (phone 513-228-1175).

**OKLAHOMA** (Altus, Enid, Oklahoma City, Tulsa): **Aaron C. Burleson,** P. O. Box 757, Altus, Okla. 73522 (phone 405-482-0005).

**OREGON** (Eugene, Portland): **Phil Saxton,** 16346 NE Tillamook St., Portland, Ore. 97230 (phone 503-255-7872).

**PENNSYLVANIA** (Allentown, Beaver Falls, Drexel Hill, Dormont, Erie, Harrisburg, Homestead, Johnstown, Lewistown, Philadelphia, Pittsburgh, Scranton, State College, Washington, Willow Grove, York): **Tillie Metzger,** 2285 Valera Ave., Pittsburgh, Pa. 15210 (phone 412-881-1991).

**PUERTO RICO** (San Juan): **Fred Brown,** 1991 Jose F. Diaz, Rio Piedras, P. R. 00928 (phone 809-790-5288).

**RHODE ISLAND** (Warwick): **King Odell,** 413 Atlantic Ave., Warwick, R. I. 02888 (phone 401-941-5472).

**SOUTH CAROLINA** (Charleston, Clemson, Columbia, Myrtle Beach, Sumter): **James Catington,** 2122 Gin Branch Rd., Sumter, S. C. 29150 (phone 803-481-2634).

**SOUTH DAKOTA** (Rapid City, Sioux Falls): **Justy Berger,** RR #3, Box 89, Sioux Falls, S. D. 57106 (phone 605-339-1104).

**TENNESSEE** (Chattanooga, Knoxville, Memphis, Nashville, Tri-Cities Area, Tullahoma): **Jack K. Westbrook,** P. O. Box 1801, Knoxville, Tenn. 37901 (phone 615-523-6000).

**TEXAS** (Abilene, Amarillo, Austin, Big Spring, College Station, Commerce, Corpus Christi, Dallas, Del Rio, Denton, El Paso, Fort Worth, Harlingen, Houston, Kerrville, Laredo, Lubbock, San Angelo, San Antonio, Waco, Wichita Falls): **Bryan L. Murphy, Jr.,** 118 Broadway, Suite 234, San Antonio, Tex. 78205 (phone 817-777-4231).

**UTAH** (Brigham City, Clearfield, Ogden, Provo, Salt Lake City): **Bruce Hampel,** 1445 27th St., Ogden, Utah 84403 (phone 801-393-1257).

**VERMONT** (Burlington): **John D. Navin,** 350 Spear St., Unit 64, South Burlington, Vt. 05401 (phone 802-863-1510).

**VIRGINIA** (Arlington, Danville, Harrisonburg, Langley AFB, Lynchburg, Norfolk, Petersburg, Richmond, Roanoke): **C. W. Scott,** 6368 Brampton Court, Alexandria, Va. 22304 (phone 703-370-2702).

**WASHINGTON** (Bellingham, Seattle, Spokane, Tacoma, Yakima): **Walter P. Lepski,** 722 Villard St., Cheney, Wash. 99004 (phone 509-235-6178).

**WEST VIRGINIA** (Huntington): **David Bush,** 2317 S. Walnut Drive, St. Albans, W. Va. 25177 (phone 304-722-3583).

**WISCONSIN** (Madison, Milwaukee): **Charles Marotske,** 7945 S. Verdev Drive, Oak Creek, Wis. 53154 (phone 414-762-4383).

**WYOMING** (Cheyenne): **Al Guidotti,** P. O. Box 811, Cheyenne, Wyo. 82001 (phone 307-638-3361).

**29th Air Service Group Ass'n**
Former members of the 29th Air Service Group, Thirteenth Air Force, will hold a thirty-eighth-year reunion on July 15–20, 1984, at the Holiday Inn, Richmond, Va. **Contact:** Frank Pace, 315 W. 15th St., Dover, Ohio 44622.

**38th Bomb Wing**
A reunion for the 38th Bomb Wing will be held on June 8–10, 1984, at the Marriott City Center Hotel in Denver, Colo. **Contact:** Polly Rau, 1290 Lansing, Aurora, Colo. 80110. Phone: (303) 364-1881.

**B-58 Hustler Ass'n**
The B-58 Hustler Association will hold its reunion on June 1–3, 1984, in Fort Worth, Tex. **Contact:** B-58 Hustler Ass'n, P. O. Box 26058, Fort Worth, Tex. 76116. Phone: (817) 249-2877.

**63d and 64th Troop Carrier Squadrons**
Members of the 63d and 64th Troop Carrier Squadrons, 403d Troop Carrier Group, Thirteenth Air Force, will hold their first reunion on June 25–26, 1984. **Contact:** Aron J. Tobiska, 31 S. Holland St., Lakewood, Colo. 80226.

**64th Bomb Squadron**
Former officers who were assigned to the 64th Bomb Squadron, 43d Bomb Group, Davis-Monthan AFB, Ariz., during the period 1946–60 are invited to attend a reunion at Davis-Monthan AFB on April 27–29, 1984. **Contact:** Wayne L. Covert, 8943 Calle Pasto, Tucson, Ariz. 85715.

**65th Fighter Squadron**
The 65th Fighter Squadron, 57th Fighter Group, will hold its reunion on June 21–24, 1984, in Las Vegas, Nev. **Contact:** Evelyn Linder, 5 Candle Rd., Levittown, Pa. 19057. Phone: (215) 945-1685.

**89th Troop Carrier Group**
Members of the 89th Troop Carrier Group, comprising the 24th, 25th, 26th, 30th, and 31st Troop Carrier Squadrons, will hold a reunion on June 7–8, 1984, at the Imperial House Motel in Dayton, Ohio. **Contact:** Ed Harvey, 612 Parkview Lane, Richardson, Tex. 75080. Phone: (214) 231-0121. Dave

## AFA STAFF PROFILES

# Membership/Insurance Goal: 'Real Growth'

**By Capt. Patricia R. Rogers, USAF**
CONTRIBUTING EDITOR

The Membership and Insurance Department at AFA Headquarters is the focal point of AFA's membership services and promotional activity. Its principal activities are to build membership and to provide quality insurance programs to members.

The insurance programs furnish life, accident, hospital indemnity, Cham*PLUS*®, and Medicare Supplement coverage to more than 48,000 members. Life insurance, with $1.4 billion of insurance in force, is the largest plan, but the three-year-old Cham*PLUS*® plan is expanding rapidly and has already become AFA's second largest plan. The Cham*PLUS*® plan provides coverage supplementary to the government's CHAMPUS program.

Richmond M. "Max" Keeney, Assistant Executive Director for Membership and Insurance, heads the Membership and Insurance Department as well as the Fulfillment Department that was featured in this space in the March '84 issue. During his twenty-five years of service with AFA, he has designed and developed all of its insurance plans, has overseen AFA's membership growth, and has managed its direct-mail programs.

"The success of our insurance programs has given me great satisfaction over the past twenty-five years, but membership growth—real sustained growth in every chapter—must be our key goal for the rest of the decade," said Mr. Keeney.

He is assisted in his work by Carol Smith, his secretary and administrative aide for twelve years. In addition to her secretarial duties, Mrs. Smith is responsible for administering AFA's membership promotion activities. That responsibility involves corresponding with all membership drive chairmen at both military installations and in AFA chapters, monitoring direct-mail programs, and compiling a large variety of statistical information concerning the membership and insurance programs. She also supervises AFA's participation in the Outstanding Airman program, which culminates with the twelve airmen being honored during AFA's National Convention each fall.

"For years and years it was just me in the Claims Section," said Linda Mathieson, Insurance Claims Manager, "but since Cham*PLUS*® was started, the claims work has just skyrocketed." Mrs. Mathieson has worked the last thirteen years of her twenty-three-year AFA career in insurance claims.

She is now assisted by Nancy Hallock and George Baglin. Mrs. Hallock, previously an employee in another AFA department, became Assistant Claims Manager in April 1981 with the advent of Cham*PLUS*®. Mr. Baglin, with more than twenty years of experience in the insurance business, joined the AFA insurance staff in May 1983 as a Special Assistant for Policyholder Service.

"You become quite attached to the people who call in for help and advice. I like to think we make it a little easier for them," said Mrs. Mathieson. The claims section at least eases their financial burdens. Last year, incurred claims exceeded $4.3 million, and payments were made to 3,902 policyholders and beneficiaries.

While the Claims Section handles specific claims, two other employees of the Membership and Insurance Department—Joanne Greene and Pamela Braithwaite—are responsible for handling all other correspondence on membership and insurance. Together they reply to as many as 1,500 members each month who have some question concerning their membership or insurance coverage. In addition to managing this large volume of correspondence, Mrs. Braithwaite supervises the maintenance of AFA's permanent insurance records and Mrs. Greene administers the Life Member program, which now provides service to more than 14,000 members.

***AFA's Membership and Insurance Department (from left): Carol Smith, Joanne Greene, Nancy Hallock, Pamela Braithwaite, Linda Mathieson, George Baglin, and Max Keeney (seated). The department provides membership and insurance services to AFA's more than 200,000 members.***

# Intercom

***Showing off his company's support of the Aerospace Education Foundation's Jimmy Doolittle Educational Fellowship program is Dr. Richard Hartunian of The Aerospace Corp., El Segundo, Calif. The company has sponsored Sherrod Skinner, Dr. Ivan Getting, Dr. Allen Donovan, and Dr. B. P. Leonard as Doolittle Fellows. (Photo by John Gambrell)***

Turner, 120 Tulip Lane, Dayton, Ohio 45432. Phone: (513) 252-4586.

**325th Photo Recon Wing**
There will be two reunions of the 325th Photo Reconnaissance Wing in 1984. The first will be held in Colorado Springs, Colo., on June 14–17. **Contact:** Hugh Scott, P. O. Box 574, Cottonwood, Ariz. 86326. The second will be held in Los Angeles, Calif., on October 3–7. **Contact:** Bob Des Granges, 165 Arroya Pinon Dr., Sedona, Ariz. 86336.

**330th Bomb Squadron**
The 330th Bomb Squadron, 93d Bomb Wing, reunion will be held on June 22–24, 1984, at Castle AFB, Calif. **Contact:** Mike Bogna, 525 Baker Ct., Atwater, Calif. 95301.

**339th Fighter Group Ass'n**
The 339th Fighter Group will hold its fifth annual reunion on July 12–15, 1984, in Denver, Colo. **Contact:** Chet Malarz, 2405 Kings Point Dr., Atlanta, Ga. 30338.

**352d Fighter Group Ass'n**
Members of the 352d Fighter Group, Eighth Air Force, and all assigned units stationed at Bodney, England, and Asch and Chièvres, Belgium (1943–45), will hold their reunion on July 26–29, 1984, in Oklahoma City, Okla. **Contact:** Al Duffy, RR #3, 802 Ridge Pl., Enid, Okla. 73701. Phone: (404) 233-5892.

**397th Bomb Group**
The 397th "Bridge Busters" will return to Europe for the fortieth anniversary of D-Day on June 4–18, 1984. **Contact:** Nevin F. Price, P. O. Box 1786, Rockville, Md. 20850.

**410th Bomb Group**
Veterans of the 410th Bomb Group and the 22d Service Group will hold their first reunion on June 1–3, 1984, at the Holiday Inn, Dayton, Ohio. **Contact:** Col. James C. Egan, Jr., USAF (Ret.), 5621 Mirador Circle, Shreveport, La. 71119. Phone: (318) 635-9648.

**453d Bomb Group**
Members of the 453d Bomb Group, 2d Air Division, Eighth Air Force, will hold a reunion on May 6–8, 1984, at the Air Force Museum, Wright-Patterson AFB, Ohio. **Contact:** Ginger Stokes Brubaker, P. O. Box 149, Westtown, Pa. 19395.

**748th Railway Operation Battalion**
The 748th Railway Operation Battalion reunion will be held on June 15–17, 1984, at the Rodeway Inn, Nashville, Tenn. **Contact:** Dallas H. Wilson, Jr., 6312 Glendale Lane, Shreveport, La. 71119. Phone: (318) 635-3646.

**6147th Tactical Control Group**
Members of the 6147th Tactical Control Group "Mosquitoes" will hold their reunion on July 12–15, 1984, in Orlando, Fla. **Contact:** Dick Stanton, 605 Sombrero Rd., Marathon, Fla. 33050. Phone: (305) 743-2705.

---

**Gardner Field**
I would like to hear from former flight

# La Mode Du Golf

## COTTON CLASSICS!

**Style #1910, $18.50**
**Features:** *4 button placket; 2 pieced fused collar; Pearl buttons; Right side pocket with flap; Double needle tailoring; collar stays; Full golfer cut.*
**Sizes:** *S-M-L-XL-XXL*
**Colors:** *White, Navy, Camel, Red, Kelly Green*

**Style #2400, $15.50**
**Features:** *Ladies version-2 Button placket; Fashion knit collar; Banded sleeves; Long rear tail.*
**Sizes:** *S-M-L-XL*
**Colors:** *White, Bone, Navy, Kelly Green, Lavender*

## CASHMERLON™!

**Style # 1001, $22.50**
**Features:** *Full turnback cuff; fully fashioned saddle shoulder; full golfer cut.*
**Sizes:** *S-M-L-XL-XXL*
**Colors:** *White, Navy, Chocolate, Burgundy*

**Style #2001, $22.00**
**Features:** *Ladies Version-Full turnback cuff; fully fashioned; raglan sleeve.*
**Sizes:** *S-M-L-XL*
**Colors:** *White, Lt. Blue, Navy and Plum*

## ALL WEATHER WEAR!

**Style #JK 1700, $31.00**
**Features:** *100% nylon water repellent rain jacket; noise resistant fabric; heavy zippers; hidden hood; action knit under arms allows for free and easy movement; Two front zip pockets.*
**Sizes:** *S-M-L-XL-XXL*
**Colors:** *Lt. Blue, Navy, Camel*

**Style #JK 2700, $30.00**
**Features:** *Ladies version of JK1700*
**Sizes:** *S-M-L-XL*
**Colors:** *Yellow, Navy, Plum*

| Style # | Color | Size | Quantity | Price |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | Shipping and handling | 2.00 |
| | | | **TOTAL AMOUNT ENCLOSED** | $ |

Enclose check or money order made payable to the Air Force Association and send to AFA, 1750 Pennsylvania Avenue, N.W., Suite 410, Washington, D.C. 20006. (D.C. residents please add 6 percent sales tax.) (Please allow six to eight weeks for delivery.)

**SHIP TO:**

Name

Address

City/State/Zip Code

# Intercom

***During ceremonies held in February, Nevada State AFA presented its Award of Excellence to the Nevada Air National Guard's 152d Tactical Reconnaissance Group based at May ANG Base in Reno, Nev. Pictured, from left, are William J. Becker, Nevada State AFA President; Col. Wayne B. Adams, NevANG, Commander of the 152d Tac Recon Group; Maj. Gen. Robert Dwyer, NevANG, Nevada Adjutant General; and Vernon Frye, President of AFA's Reno Chapter.***

instructors and administrative personnel, including WASPs, who served at Gardner Field, Calif., for the purpose of organizing a reunion.

Please contact the address below.

Frank Keeney
330 Grover Ave., East
Massapequa Park, N. Y. 11762

**6th Bomb Group**

Former members of the 6th Bomb Group, which included the 24th, 39th, and 40th Bomb Squadrons, are trying to organize a reunion to be held either late this year or in 1985 to commemorate the fortieth anniversary of the war in the Pacific.

Please contact the address below.

Newell W. Penniman, Jr.
6 Porter Lane
South Hamilton, Mass. 01982

**8th Combat Cargo Squadron**

I am trying to establish a mailing list of pilots from the 8th Combat Cargo Squadron, 2d Combat Cargo Group, who served in the Pacific from October 1944 to December 1945.

Please contact me at the address listed below.

Paul Vaughan
1801 S. Hill St.
Los Angeles, Calif. 90015

**26th Photo Recon Squadron**

I am trying to contact veterans who served with the 26th Photo Reconnaissance Squadron from 1942–45 for the purpose of planning a reunion.

Please contact the address below.

Lt. Col. H. C. McCullough, USAFR (Ret.)
P. O. Box 2141
Lafayette, La. 70502

**43d MR&R Squadron**

A convention is planned for May 1984 for members of the 43d Mobile Reclamation and Repair Squadron, Ninth Air Force.

Please contact the address below.

Gordon Lindeblad
6 Windermere
Bella Vista, Ark. 72714
Phone: (501) 855-1034

**Class 44-J**

I would like to make contact with members of Class 44-J (Pecos and Marfa, Tex.) for the purpose of planning a reunion.

Please contact the address below.

Donald F. Bean
Rte. 2, Box 127-S
Dayton, Ohio 97114

**50th Troop Carrier Squadron**

I am interested in hearing from members of the 50th Troop Carrier Squadron, 314th Troop Carrier Group, regarding a reunion to be held this year in Las Vegas, Nev.

Please contact the address below.

Robert J. De Maria
50th Troop Carrier Squadron Association
12896 Roadrunner Dr.
Penn Valley, Calif. 95946
Phone: (916) 432-0356

**Class 52-A**

I would like to communicate with members of Class 52-A, and crew members of the 64th, 65th, and 66th Fighter-Interceptor Squadrons who were based in Alaska from 1952–55, for the purpose of planning a reunion.

Please contact the address below.

Lee A. Lendt
2777 Carter Farm Ct.
Alexandria, Va. 22306
Phone: (703) 360-7013

*Holly Feeney, center, was recently awarded an AFA Citation by AFA's Dallas Chapter in recognition of her support of the Chapter's many activities. Presenting the citation is National President David L. Blankenship. Looking on is Chapter President William A. Solemene.*

**487th Bomb Group**

A July '84 reunion is being planned for former members of the 487th Bomb Group.

Please contact the address below.

Vernon L. Gibbons
6018 W. Marlette Ave.
Glendale, Ariz. 85301

## Coming Events

April 28, **Massachusetts State Convention,** Wakefield . . . May 4–6, **Alaska State Convention,** Anchorage . . . May 5, **Maryland State Convention,** Rockville . . . May 11–13, **Washington State Convention,** Spokane . . . May 19, **Illinois State Convention,** Rantoul . . . May 19, **Missouri State Convention,** Independence . . . June 1–2, **North Dakota State Convention,** Grand Forks . . . June 8, **Alabama State Convention,** Montgomery . . . June 9, **Louisiana State Convention,** Alexandria . . . June 29–July 1, **New Jersey State Convention,** Cape May . . . July 13–15, **Pennsylvania State Convention,** Carlisle Barracks . . . July 27–29, **Florida State Convention,** MacDill AFB . . . August 9–11, **Utah State Convention,** Ogden . . . August 17–18, **New York State Convention,** Mitchel Field . . . August 18, **Michigan State Convention,** Southfield . . . August 23–25, **California State Convention,** Irvine . . . August 24–26, **Oregon State Convention,** Portland . . . September 16–20, **AFA National Convention and Aerospace Development Briefings and Displays,** Washington, D. C.

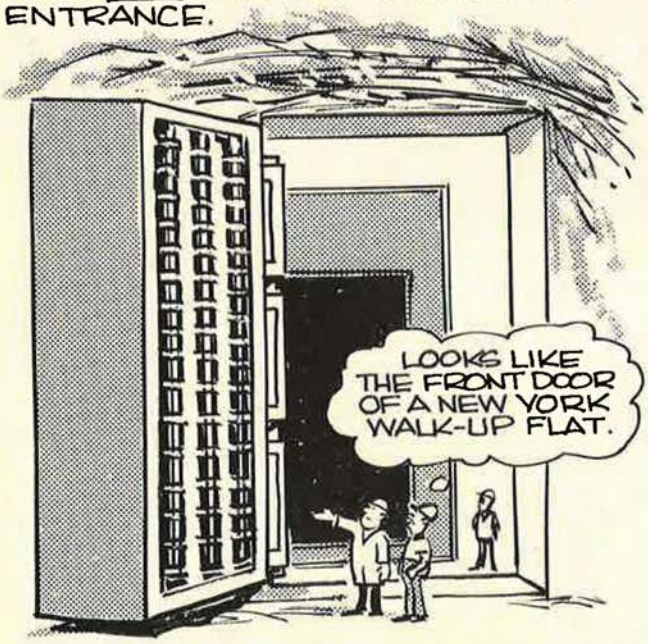
Bob Stevens'

# "There I was..."

COMBAT OPS CENTER IN COLORADO. THIS UNDERGROUND (9,500' OF GRANITE) CITY MONITORS SURVEILLANCE DATA FROM ALL OVER THE WORLD TO WARN OF AN IMPENDING ATTACK.

NORAD'S SATELLITE and RADAR EYES ALL TERMINATE HERE IN THIS SUBTERRANEAN COMMAND POST.

STEEL BLAST DOORS WEIGHING **25 TONS** *EACH* STAND AT THE TUNNEL ENTRANCE.




A *MILLION* POUNDS OF EXPLOSIVES WERE USED TO BLAST OUT NEARLY 3 MI. OF TUNNEL & CHAMBER SPACE!


THE CHEYENNE MT. YACHT CLUB PATROLS THE 4 WATER RESERVOIRS INSIDE THE MOUNTAIN—


(P.S. AN AIRMAN RECENTLY RE-LIPPED ABOARD THE WORD SMITH!)

IN THE MISSILE WARNING CENTER AN ACCURATE TAB IS KEPT ON ALL THE SPACE JUNK IN ORBIT—

# Excellence


## Taking the Lead in Software Engineering

Vitro, with its extensive array of hardware and software, has emerged as a leader in the software engineering field. Vitro software engineers and programmers are versed in the latest languages, such as Ada, and techniques, such as software verification and validation. Whether developing software for a major combat system or for tactical command centers, Vitro has become synonymous with excellence in software engineering.

Today, Vitro's ongoing successes include computer program design agent for the Ground Launched Cruise Missile Weapon Control System, for TARTAR and TERRIER Weapon Direction System MK 14 and Digital Fire Control System MK 76, and for the U.S. Coast Guard's Command, Control and Display (COMDAC) system. Vitro also furnishes support software and system simulation for those programs. Vitro software engineers develop programs for system modeling and simulation, test and evaluation, and computer-based training.

Clients have confidently turned to Vitro for over 20 years to meet their computer-based support needs. Vitro's combination of experience, technical capability, and facilities is outstanding.

Vitro Corporation stands ready to build upon its successes in software engineering . . . to continue a tradition of excellence.

**Vitro**
**CORPORATION**

14000 Georgia Avenue, Silver Spring, Maryland 20910
For information call our Marketing Manager, (301) 231-1300

# THE C-17. IT'S THE ONLY AIRLIFTER THAT CAN ELIMINATE THE MIDDLEMAN.

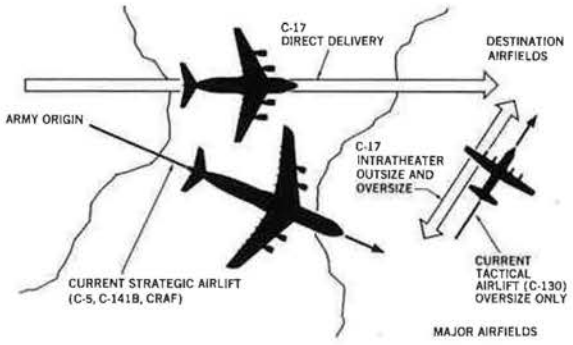
Right now, military airlift is primarily a two-step operation. Large airlifters move cargo from our shores to a base near the forward area. As near, that is, as the nearest runway long enough to accommodate them. Smaller aircraft must complete the haul into small airfields. Combat equipment too large for the small planes must move forward by surface transportation.

The new C-17 will end the need for transfers en route. The C-17 will make direct deliveries from the U.S. to forward areas anywhere in the world.

What makes this possible? The proven combination of a new wing design and an innovative propulsive-lift system that lets the C-17 land on very short runways. Only 850 runways in the world are able to accommodate current strategic airlifters; the C-17 can land on more than 10,000.

The ability to land and take off from minimum length facilities lets the C-17 double as a shuttle transport within a theater of operations. This means the C-17 will carry critical cargo to our forces when needed, where needed, and lose no precious time in transfer.

The new C-17 from McDonnell Douglas. It will move the U.S. Air Force and the U.S. Army into the twenty-first century.




**MCDONNELL DOUGLAS**